THE

# ELECTRICAL REVIEW.

VOL. LXXIII. DECEMBER 19, 1913. No. 1,882.

## ELECTRICAL REVIEW.

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1914 EDITION.

**IN PREPARATION.**

***H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.***

## LONDON'S ELECTRICITY SUPPLY.

ALTHOUGH we commented on this question in our last issue, our attention is already recalled to the matter by the publication of a scheme for the solution of the great problem of supplying the Metropolitan area with electricity on lines in accordance with the practice of the present day. The idea at the root of the scheme is not new; it has been before the public in a more or less nebulous form for some months, but now the outlines of the proposal are taking more definite shape and light is thrown upon many incidents which have hitherto possessed no apparent connection with one another.

In brief, the scheme is to form a large "holding company" which shall acquire control of the existing companies operating in the London area, by purchase or exchange of shares, and which shall then proceed to unify and co-ordinate the various undertakings on a sound basis, retaining such works and plant as are capable of economical operation under the new *régime*, closing works which are not suitable for inclusion, erecting new bulk supply stations outside the city, and so on.

The undertaking would be, of course, of enormous magnitude and importance, and the process of amalgamation would have to be spread over many years; very large amounts of capital would have to be raised on the security of debentures, and the utmost care would be necessary to ensure the financial stability of the concern.

But, apart from the financial and technical aspects of the question, each of which presents problems of the greatest complexity, there is a third consideration of even greater weight, which will have to be dealt with before a single step can be made towards the fulfilment of the project; and that is the political aspect of the matter. The London County Council possesses the statutory right to purchase all the private undertakings at the expiration of the period of 42 years from their inauguration, on terms which have never been defined; and whether the Council decides to exercise that power or not, it is certain that it will claim the right to an important share in controlling the course of events. Up to the present the Council has not adopted any definite line of policy, but it has appointed a Committee to investigate the circumstances and to prepare a report, which, it is expected, will be ready some time next year. It is understood that the promoters of the new scheme will introduce their proposals in the form of a Bill in the next session of Parliament, and unless the Council is in a position to introduce a Bill embodying its own proposals at the same time, it will be compelled to enter opposition to the company's Bill in order to obtain a hearing on the matter. In any event, it seems clear that the hands of the Council will be forced by the action of the company, and the former will be obliged to define its future policy; thus the battle will almost certainly be joined next year, and, as we remarked last week, the supply of electricity to London will become the question of the hour.

It appears that a unique opportunity is now at hand for the reorganisation of this great industry, which at present is in a state of chaos. If the attempt were made to adopt a single uniform system of distribution throughout the area, the

cost would undoubtedly be very heavy, no matter what system was adopted; but we doubt whether so drastic a step would be either necessary or desirable. Certainly in some cases fundamental changes should be made, to remove anomalous voltages and frequencies; at present the cost of these alterations would fall upon the supply authorities, and, therefore, upon the consumers in the areas concerned, and this would obviously be unjust, seeing that Parliament deliberately split up the metropolis into separate districts of supply, and the object of a change of system would essentially be that of benefiting the whole of London. The cost of such changes should, therefore, be distributed over the whole area. But the problem of reducing the variety of supplies to one voltage for both A.C. and D.C., and one frequency for A.C., would be less difficult than might appear at first sight. Probably the greater loss would be entailed by the scrapping of old generating plant and the substitution of converting or transforming plant, with the necessary trunk feeders. These questions, however, need not detain us at the moment. The more important question is the broad one of policy. Will the County Council insist on taking over the whole business, lock, stock and barrel? Or will it agree to the conduct of the business by a "holding company," subject to the provision of suitable safeguards for the interests of the public? Or will it enter into a compromise with the representatives of the companies, whereby it will assist in financing a scheme of reorganisation, whilst retaining control of the policy of the undertaking, but avoiding interference with the commercial and technical management of the concern? Each of these alternatives has its own advantages and drawbacks. In this connection the views of Mr. R. A. Chattock, a leader in the field of municipal enterprise, and Mr. George Offor, a pioneer in the electrical industry on the company side, will be read with interest elsewhere in this issue; they deal not directly, but certainly not remotely, with the question which is now before the London authorities. To these we may add the opinions of Mr. Frank Bailey, expressed in his paper before the Society of Arts in April last,* on "Electric Supply in London," as being worthy of close consideration. Mr. Bailey points out that no great city outside the United Kingdom entrusts its electricity supply to municipal enterprise. Chicago, Berlin, Paris and Buenos Ayres are cited in support of Mr. Bailey's remarks, and it is noteworthy that, as in Berlin, so in Paris—where the process of reorganisation is approaching completion, the concession to the Compagnie Parisienne de Distribution d'Electricité coming into force on January 1st, 1914—the municipality has adopted the plan of leasing the business to a company subject to a heavy annual payment, with the right to terminate the arrangement at stated dates.

Our own view of the matter is emphatically opposed to the first of the three alternatives that we have outlined. Between the second and third it is less easy to decide, but on the whole we favour the third as providing the most efficient safeguards for the interests both of the public and of the shareholders, and the best prospects of disarming opposition to the scheme of reorganisation. As we have already pointed out, the tendency in Germany is in this direction, and while we do not advance this fact as a sufficient reason for our following in the same path, we think that the experience gained abroad in this connection strongly indicates that the plan offers excellent prospects of a satisfactory outcome.

**Christmas and Codicils.**

With the approach of the season for "Christmas Cheer," the period for ghostly stories in the firelight, the E.T.B.I. reminds us that whether we eat, drink and be merry or no, to-morrow we shuffle off this mortal coil! The Benevolent Institution is an excellent organisation—everybody knows that we are amongst its most ardent well-wishers, and the idea suggested at the last annual meeting for the circulation of legacy slips once a year was a capital one, but "Christmas comes but once a year, and when it comes it brings"—what? the spirit of a good old-fashioned festive season? Away with all such—sit thou down, dear reader, scan again that last will and testament of thine, and write a codicil! Let it be in proper form, as drawn up by the Benevolent Fund's Executive, that there be no mistake, lest when another Christmas comes thine own erratic form haunt secretary and executive.

Perhaps the reader may have thought that there are other times in the year more fitting for the issue of such a request as this; in case that may be so, we venture two alternative suggestions. One is that the thing be filled in, signed and witnessed now, right on the spot, and got out of the way; the other that the new year, when some men make a practice of turning over a new leaf, be started well by making the desired addition. All that the executive is out for is the strengthening of the funds of the Institution, so that available resources may justify pension allowances. This codicil has been drawn up to make it as easy as possible for would-be legators to make proper preparation so that the Institution shall eventually receive that benefit which so many wish to grant from their estates, but for which they have so far neglected to make the necessary testamentary provision. The E.T.B.I. will take the greatest possible pleasure in sending copies of the above Christmas card to anybody whose name and address are received by them during the next few days.

**Lead.**

Since last writing the Lead Market has displayed considerable irregularity, prices at one time showing a substantial depreciation with a most unsettled feeling, while this phase was followed by a better market and a moderate restoration of confidence. There have been rumours about of heavy quantities of lead arriving, and of substantial lots being put into warehouse, but the apprehensions on this score proved to have been overdrawn, and the discovery that there was no immediate actual alteration in the fundamental conditions of the market did a good deal to restore waning confidence. At the same time it must be admitted that there is not nearly such a buoyant feeling about as there was, and a much more modified view is now taken of the position and prospects. The high prices witnessed this year have undoubtedly hindered the normal growth of consumption, and since trade everywhere appears to be slackening, it is a very good thing for the market at large that prices should have come down to a more reasonable level. Latterly there has been too much ragged speculation in lead and a restriction of the use of the metal as a mere gambling counter would be a good thing for all concerned.

This, however, is merely a side issue. After the sharp decline in the price there was a considerable amount of "bear" covering, which had the inevitable result of tending to strengthen the price, and a moderate degree of confidence was restored, but nobody now believes that the £20 level, or anything like it, is to be justified. A little home trade buying has developed, and this, in conjunction with some scattered export orders, combined to assist the recovery, which, however, did not proceed very far, though the chances favour a pretty steady to firm market in the near future, with, of course, fluctuations.

What is a satisfactory feature is that although the arrivals of lead in London have recently been quite heavy, all the metal which came to hand was taken up easily, and it has not been possible to trace any surplus material. At all events, the price of immediate and near deliveries has been maintained at a premium over forward metal, and this could hardly be the case if spot stuff were pressed. Conditions at the producing centres are easier, however, and no doubt, with a continuance of output on an enlarged scale, there will be a corresponding growth in the quantities reaching European centres, and rendered available for consumption. If so, the tendency of the market generally should be towards relaxation, but the process, under normal conditions, should be a gradual one.

* Elec. Rev., April 18th and 25th, 1913.

In any event, it is not wise to anticipate any material difference between the course of lead prices and conditions and those which obtain as regards other metals. The general outlook is not bad, but there is nothing whatever now in the situation to warrant anticipations of materially higher prices than those in evidence to-day, and the broad tendency should be in the direction of an easement as time goes on. The Mexican position remains pretty well as involved as ever, and it really seems to be quite useless to expect any amelioration of affairs in this distressed country for months to come.

The events of the last few weeks have not helped to put industrial conditions there on any better basis, and the resumption of mining and smelting operations seems likely to be deferred for an indefinite period, because most of the mining areas seem to be badly involved in the civil war, while even the ports are now the centres of fighting. Really the position has gone from bad to worse. It is hopeless, therefore, to look to Mexico to supplement the supplies at present coming forward, and these are to all appearance ample for the satisfaction of trade needs. Hence, any resumption of shipments from there would be the signal for a sharp attack on the market.

Failing the development of any fresh features of importance, the price is likely to keep from steady to firm with moderate fluctuations, and, of course, should there not be any resumption of supplies from Mexico by the spring months when export demands on a liberal scale have usually to be satisfied, there may be a moderate upward movement, but this is looking rather far ahead.

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**Nottingham Exhibition.**

Some time ago we drew attention to the "Universal Exhibition" which is to be held at Nottingham next year, from May to October, and pointed out that it would appeal to a population of no less than 12 million people within easy range of its attractions. We understand that the intention is to make it by far the largest Exhibition ever held in the Provinces, and that the plans are already far advanced. Unfortunately, however, according to present indications, the electrical industry is not likely to be adequately represented at this very important show—probably because the leaders have not fully realised its importance, though other branches of the engineering industries have promised their support.

While we do not suggest that manufacturers should attempt to exhibit heavy machinery, in view of the great cost and inadequate return on such a proceeding, we do think that every effort should be made to ensure that there shall be an ample representation of the lighter apparatus, particularly consumers' appliances for lighting, heating, cooking and motive power. The importance of this will be better appreciated when we state that the Nottingham Corporation, although it possesses a large electricity supply undertaking, has thrown its whole weight into the scale in favour of the gas department, and has taken a building covering an area of 15,000 sq. ft., to be called the "Nottingham Gas Pavilion," wherein a most elaborate and comprehensive display of gas engineering and apparatus will be organised, and the interests of the gas department will be strenuously promoted. The greater portion of the splendid river frontage of the Exhibition, extending for about half a mile, will be lighted with gas, and half the grounds with high-pressure gas; the gas department has done its best to induce the Exhibition authorities to light the remainder of the grounds with gas, but, fortunately, they have stood fast by electricity for this purpose.

It will be seen, then, that unless immediate steps are taken to prevent so regrettable a result, the Nottingham Exhibition of 1914 will represent a triumph for gas. The time available is short, and we sincerely hope, in the best interests of the electrical industry, that our manufacturers will realise before it is too late the importance of defeating the plans of their rivals by securing space at once, and preparing exceptionally attractive exhibits of their products.

**Openings for the Electric Vehicle.**

That the gas engineer, in his efforts to meet the ever-growing competition of electricity, not only for lighting, but nowadays for heating and cooking also, has in many cases adopted both electric lighting and electrically-driven machinery in the gas works, is only a natural development. It would have been surprising had he not done something of the kind, when one considers that the convenience and safety of electrical methods have almost compelled their adoption in far more salubrious and certainly far less dangerous industries than gas manufacturing.

It seems quite possible that this community of gas and electrical interests could be still further extended, judging by the costs of motor haulage in connection with various gas undertakings, mentioned at the recent meeting of the Southern District Association of Gas Engineers and Managers. The electric battery vehicle, like other things electrical, is simple, inexpensive in use, convenient, and, compared with other motors, free from fire risk; a figure of 2½d. per car-mile for 4 or 5-ton vehicles has been found in the States to cover everything, including liberal depreciation, and there is, therefore, no reason why our gas friends should continue to pay for running costs only over 6d. per ton-mile for 30-cwt. petrol vans, and 2·3d. to 3·17d. per ton-mile for steam haulage as at Bournemouth, or on a mileage basis only, 7·5d. per mile for a 30-cwt. van, and from 3·6d. to 5·4d. per mile for 15-cwt. vans, as appears to be the case with the Gas Light and Coke Co. As regards this company, a figure inclusive of depreciation, for a 2-ton vehicle, has been mentioned, viz., 10d. per mile.

At Norwich the costs are apparently 2·5d. per ton-mile for steam, 6d. per ton-mile for petrol, and 8¾d. in the case of horse haulage, for a typical 11-mile journey.

We are, of course, aware that figures for haulage costs, quoted off-hand, do not afford an accurate basis for comparison, but the fact remains that given suitable, though not specially chosen, conditions, electric vehicles are now running in this country—with charging energy at 1d. per unit—at a cost for electricity of ½d. per mile, and we do not think that either petrol or coke fuel can compete with such a figure.

At the meeting in question, 1½d. per "ton-mile" for petrol and ·55d. to ·74d. per "ton-mile" for coke fuel were mentioned.

The steam wagon appears to be favoured because it is more robust and easily repaired; moreover, it uses a by-product as fuel.

The electric vehicle is, however, easier to handle and repair than any other, and if the consciences of our gas friends can be strained to the extent of using electricity in their works for power and lighting, no doubt they can be stretched sufficiently to cover a few battery vehicles, especially if the batteries are charged from a gas engine-driven plant—the indirect use of gas being the solatium in such a case.

Another possible opening for the electric goods carrier was mentioned by Mr. Mallins in his recent report on goods transport matters in connection with the port of Liverpool and the South Lancashire manufacturing centres.

Although mainly dealing with tramway matters, Mr. Mallins points out that for the local traffic between the docks and railway stations and warehouses—which, owing to the peculiar conditions existing at Liverpool, has attained enormous proportions, resulting in congestion of quays and roads—some 11,000 horse and 124 mechanically-propelled vehicles are in use.

He is of opinion that if a well-organised system of mechanically-propelled vehicles, possibly of the electric battery type—with a cheap power supply—were provided, the work could be performed by 50 per cent. fewer vehicles, which would greatly relieve matters. The negligible fire risk of the electric vehicle—a feature to which we have already referred above and one which should specially appeal to the dock authorities—and the short heavy hauls which we believe prevail in connection with this traffic, are strong points in favour of the "electric," the adoption of which would, no doubt, receive material assistance from the city's electrical department.

## NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

A BY-LAW for the construction of a municipal electric light plant is likely to be voted on soon by the ratepayers of South Vancouver, B.C., and one to raise $150,000 for extensions to the plant at Medicine Hat, Alberta, is to be put forward in a few days. The cost of the former is estimated at $300,000.

In Hamilton, Ontario, the Dominion Power and Transmission Co. is considering the question of installing two 10,000-H.P. steam turbo-generators. A Marconi wireless station is being erected at Port Nelson, Hudson Bay, to facilitate the work of constructing the Hudson Bay Railway, which is now in progress. The railway is intended to give an outlet for the grain shipments from the West, which are now so large that it is impossible for them to be efficiently handled by the present railway routes and the shipping facilities on the great lakes.

The Toronto Hydro-Electric System has made a contract to supply 2,500 H.P. to a local firm, and is laying a 13,200-volt three-phase underground cable for the purpose. The Canadian Stewart Co., who recently obtained the contract for dredging the harbour, on the improvement of which, as already stated in these notes, several million dollars are to be spent, are apparently intending to make extensive use of electricity in their operations, as they have asked the T.H.E.S. for rates for the supply of 8,000 H P.

The City of Toronto is calling for tenders for the installation of a complete "mechanical filtration plant, boilers, steam turbo-generator plant, and all appurtenances." These have to be delivered by noon on January 20th, 1914.

About this time last year a substantial reduction in rates charged to consumers was recommended by the Hydro-Electric Power Commission, of Ontario, to all the municipalities served by this body, with about three exceptions. Reductions of from 10 to 18 per cent. have just been recommended on lighting and power rates in Toronto, Ottawa and London; other reductions have not yet been announced.

It is said that two companies are willing to relieve the transportation difficulties at present existing in Montreal. The Montreal Tramways Co. offers to build underground railways, while the Canadian Autobus Co. wants to carry out similar work. A new company, called "Electrical Properties, Ltd.," has just been incorporated in the city referred to, the capital being one million dollars.

From Niagara Falls comes a report that a water and power scheme to cost about 2½ million dollars, which will apparently be found in Great Britain and Canada, is proposed, half of the water from the American and Canadian sides of the Falls, respectively, being tapped. At Sault Ste. Marie, the Michigan Northern Power Co., and the Algoma Steel Corporation wish to utilise water-powers on the St. Mary River to supply electrical energy for industries both here and in the U.S.A. The plans have been submitted to Ottawa and Washington for approval.

## CORRESPONDENCE.

*Letters received by us after* 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Concerning a Review.

In view of all that has been written lately in the electrical Press, by editors and correspondents, by reviewers and "reviewed," on the reviewing of books, the writer begs leave, first of all, to state his own convictions.

These are that a review of a book should comprise: (1) Impartial statements alike as to the book's shortcomings and its good points; (2) a summary of contents—letterpress and appendix; (3) name or initials of the reviewer—excepting when the author of a book reviewed chooses to remain anonymous.

To come, now, to a concrete instance, namely, the review in the ELECTRICAL REVIEW of December 5th of "Graphs in a Cable Ship Drum Room: Notes for Junior Assistants," hereafter, in this article, referred to as "the book."

Regarding the book itself, its modest pretensions are clear enough. While giving prominence to the work of Bright, Brunelli, Ciceri-Smith, Clark and Sabine, Munro and Jamieson, Wilkinson, and of Werner Siemens, it claims (1) to offer parallel series of exercises useful and interesting to the "Junior Assistant"; (2) to lay before the young aspirant various graph possibilities and modes of figuring; (3) to suggest a graph method involving the limitation of tables to one set—example 38—*applicable to all cable types*, with subsequent correction from the percentage curve—page 20—once the cable circumference has been measured (in old worn cable a varying quantity even in the same type); (4) to describe the author's alternative devices for facilitating drum-room graph work. All this, having no direct connection with the author's own ship work, which all along has been on the electrical side, has been put forward tentatively as regards new methods, but always on the basis of actual experience, gained by close contact with actual sea work and the men who carry it out. There is also an appendix of tabulated matter, much of which is new.

The writer of this letter is very much afraid that any reader who may derive his first ideas of the book from the ELECTRICAL REVIEW criticism will scarcely become aware of the book's actual claims as here summarised. The title, even, at the head of the review in question is not complete. In the book itself there is no full-stop after . . . . "Drum-room," but only a colon which precedes the completion of the title, namely, "Notes for Junior Assistants," thus showing the main purpose of the book at its beginning, and not at the end, as in the review.

The writer s sincere thanks are accorded to the reviewer (1) for his close study of the book; (2) for his having pointed out the slip $d_1$ instead of $d_3$ in Example 34; (3) for his useful information regarding the construction of celluloid disks, and he now begs to be allowed to answer other queries seriatim.

The "certain marks" in figs. 3 and 4 on graph lines previously drawn between two calculated points are merely by way of an illustrative exercise corroborative of past work.

The reviewer's words: "The introduction of the drum constant reciprocal on pages 14 and 15 is a little unfortunate, as it is never required," give to the writer as hard a knock as is compatible with the exigences of courteous intercourse. The pity of it is that this dogmatic statement does not accord with facts.

Not only are *constant* reciprocals—as expressing corrected drum revolutions in terms of the nautical mile—in frequent use, as may be seen in submarine cable expedition records in the I.E.E. library, but the advantages their use offers are self-evident, and the five figures following the "0·00" . . . in the reciprocal are easily dealt with by the Fuller slide rule.

On inquiry quite outside his own circle of work, the writer finds on absolute authority that at least three important submarine-cable contracting firms invariably employ drum-constant reciprocals for paying-out purposes. In this connection the remark has been made that it is hard to see how any other constant than a reciprocal could be used with the arithmometer—a favourite instrument with at least one of the leading firms.

The reviewer tells us that division on the flat slide rule is more readily performed than multiplication. The writer does not agree. As a matter of fact, the calculator almost invariably used is Prof. Fuller's cylinder, with its logarithmically divided helical line 500 in. long, and workable to five places; but whether with this or with the small flat rule, multiplication is often preferable to division.

With several quantities, each to be divided by a common divisor, a good way with the Fuller is to set a cross index to the reciprocal of the divisor. Then each subsequent multiplication involves only one readjustment of the outer cylinder. With the ordinary small flat slide-rule, multiplication of several factors by one reciprocal is a still more simple matter, as the rule, once set, any number of products may be read straight off without readjustment of the slide-

rule; though to not so many places as with the Fuller. Readers will forgive these details. It was not the writer who started them.

With regard to the critic's reference to the list on page 14, the cable circumferences were, in each case, taken from the mean of 12 tape measurements. The means happen to have been recorded to the third place. The drum-constants obtained from the curve are stated to two decimal places. The reduced graph as shown on page 15 had its ratio graph lines considerably thickened by the printers for reproduction purposes. In practice a hair line would be used, and a much larger sheet.

Regarding examples 36, 37 and 79, the writer sees no reason for modifying his words.

To deal, now, with the reviewer's criticisms of the calculator boards on pages 28 and 32.

The book clearly emphasises the fact that the board on page 28 (which the reviewer wishes had been omitted) while capable of dealing with all cable values, has been devised for the avoidance of converging origins; a kind of *tour de force*, in fact. Also, it is quite in keeping with the purpose to which the book is dedicated, and is easily worked.

The reviewer's preference for the calculator board on page 32 has, in so many words, been anticipated by the writer on p. 31.

As for the means for setting the cursor-threads, certainly these "might be improved in obvious ways," but at what increase in the price of the board? The present simple devices have worked well.

Surely the reviewer's searching examination and, in some respects, highly detailed description of the boards might have included some brief mention of two leading features upon which, from quite unexpected quarters, the writer has been much complimented. Reference is here made (1) to the device on page 32, in which the set vertical cursor indicates not only cable *knots*, but also the required corresponding drum revolutions per minute for any one of the many cable types aboard, these latter values being on a slip easily renewable for each fresh cable expedition; and (2) to the writer's quite new application of Morse signal figures or numbers as a means for quick identification of sectional lines and curves on the boards; a system capable of limitless application elsewhere.

While cordially thanking the reviewer for his concluding remarks, the writer must add a word on behalf of the average junior assistant. This youngster, probably for the first time on a cable-ship prior to returning, at the end of the trip, to the comparative monotony of fifth-form or sixth-form routine at his school, is keen as mustard on new work which is no "pill" to him "well sugared" or otherwise.

It may be well here to mention that among the photographs kindly referred to by the reviewer, four blocks were made specially for the book to the writer's order, as likewise five new blocks of tables and a diagram, so—as the reviewer has pointed out—the book is much more than a reprint of the Electrical Review articles.

The writer has ventured to review his reviewer only in pursuance of a duty he owes to the Editors of the Electrical Review, who accepted his articles, and to the publishing firm who brought out the book.

**E. Raymond Barker.**

London, *December 8th*, 1913.

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### Canadian Electrical Trade.

To one who, like myself, has staked considerably on the chances of success in the supply of British electrical machinery suitable for the Canadian market, Mr. Berry's letter has a good deal of interest. With a great deal of what he says in his instructive letter I cannot but find myself in agreement, but at the same time I feel also that, while dealing with the results of the observations which he made during his trip through Canada, he has rather overlooked the causes which have operated to produce the state of affairs which he criticises.

It is not my purpose in this letter to deal at length with the facts and arguments which Mr. Berry states and uses, but I think that the briefest possible reference to the causes as they appear to me may be of interest.

It should be remembered that Canada is, by its geographical situation, intimately linked up commercially with the United States of America. When we couple this with the fact that that country has been the home of the electrical manufacturing industry on a large scale from its earliest infancy, is it surprising that Canada, requiring as she did some rules and regulations for the control of her enormous hydro-electric power schemes, should turn to the practice of her great neighbour?

The American electrical manufacturer, entrenched as he is behind tariff walls which have secured him from foreign competition, and being in touch with Canada over the thousands of miles of international boundary line which alone divide the two countries, has naturally turned his attention to the market lying at his hand, and as soon as he found that the Canadian traffic was operating against him, put down branch works in the country which to-day supply the great bulk of the electrical machinery which Canada absorbs.

With this we cannot quarrel. The history of some of our greatest electrical manufacturers reminds us of their early connection with the American industry, and from experience I can say that the plant turned out by the Canadian manufacturer to-day is equal to the best product of Britain or the European Continent. Considering further the fact that our home manufacturers for years past have been too much occupied in cutting prices to a point at which there was no margin to allow for setting aside sums to develop business in a country like Canada during the time when the industry there was comparatively in its infancy, I think we can see why at the present day the Chicago Board of Underwriters and its regulations are the recognised authority for the acceptance of suitable electrical equipment on the other side of the water.

Only in recent years, when the Canadian market has grown to such enormous dimensions, have British firms tackled the problems of meeting Canadian ideas with any real zest and determination. Those of us who have so done have found in some cases to our chagrin that certain classes of apparatus cannot be installed in Canada without the seal and approval of the Board of Underwriters quoted above, as laid down in what is known as "The National Electric Code." Fortunately, the code gives little trouble to the supplier of plant as opposed to apparatus, and therein possibly Mr. Berry, as a manufacturer of the latter, has looked on the subject somewhat from one point of view alone. The items which he has selected for criticism, however, will illustrate how open the code is to advantageous improvement, but any movement which could be expected to be crowned with success must, in my opinion, come mainly from within the country rather than without. The reason of this is that Canada has built up her electrical industry to suit her own special conditions, which are entirely different to those found in the old country, and only prolonged experience can teach the British electrical expert wherein she can, with advantage, adopt our methods, and wherein, on the contrary, she is doing better on the lines at present being followed.

In conclusion, I would like to draw your attention to, and give one illustration of, the fact that the Government of the country are entirely sympathetic to regulations which, in their opinion, make for increased safety of life. In considering the illustration which I give, it must be remembered that in Canada this class of legislation is not dealt with by the Dominion but by the provincial Governments, and hence concerted action is not always possible.

I have before me at the present moment a copy of the rules for the installation and use of electricity in mines passed by the Government of Alberta by order in Council dated September 17th, 1913, and on studying these rules I find that, with two important exceptions and a number of minor details, these rules are word for word a copy of the electricity rules in force in this country as adopted after investigation and discussion between the Home Office and the mining industry of Great Britain.

The exceptions referred to are (1) that the Government of Alberta prohibit altogether the use of electricity underground above 600 volts, and (2) allow the use of electrical locomotives underground with the special consent of the Minister responsible for the safety of mines. The date for

complete compliance to these regulations is January 1st, 1916, as against 1920 in our own rules.

It seems to me this case is clear evidence of the desire of the authorities to take every possible precaution to secure the highest degree of safety in the mining industry, at any rate, where electricity is used. If the state of public opinion in the country permits, or, perhaps I should say, encourages, the passing of regulations such as these, by Order in Council, the day cannot, I think, be very far distant when much more general adoption of rules to secure protection of life from electrical accidents will be established by the responsible authorities on lines more or less similar to those which are accepted here in the United Kingdom. In the meantime, those acting as representatives of British firms in Canada, or in touch with her electrical industry, can do much to further the cause which is, I think, the root problem raised by Mr. Berry's letter, viz., that of standardisation in Canada of rules and regulations for the use of electricity more in consonance with British practice than the National Electric Code, while at the same time designed to suit the purely local conditions and problems which are so much at variance with those found in the Old Country.

**C. Atherton Atchley.**

Glasgow, *December 10th*, 1913.

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### Christmas Presents.

I should be glad to know whether members of the B.E.A.M.A. are prevented by reason of their agreement from sending Christmas presents to their customers.

If I am correct in my assumption, may I also inquire whether all members of the B.E.A.M.A. are intending honestly to observe this condition?

**Anti-Corruption.**

*December 11th*, 1913.

[In regard to the last paragraph of our correspondent's letter, we are not aware that it is possible for one to know the intentions of the rest. In regard to the general principle involved, it may be said that the arrangement introduced by the National Electrical Manufacturers' Association respecting Christmas presents was continued by the B.E.A.M.A. Members of the latter, while having perfect liberty of action in distributing personal "Christmas cards" to their friends, have through their organisation a suitable means of dealing with the matter if it exceeds moderate limits.—Eds. Elec. Rev.]

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### Boiler Furnace Efficiency.

In reference to your remarks in your issue of the 28th ult. on the above subject, it does not appear to be fully recognised that boiler furnace efficiency—or inefficiency—depends mostly upon the nature of the fuel fed into it, other conditions being equal. Some of your readers may have had the disappointing experience of obtaining about equal evaporation with different fuels of apparently widely different heating value. During the combustion process coal is split up into its carbonaceous and gaseous constituents, which require widely different conditions to ensure their complete combustion and realisation. Roughly, to obtain smokelessness the gaseous constituent requires about double the amount of air necessary for the complete combustion of the solid or carbonaceous constituent and, in common practice, the air supply to the furnace cannot be so nicely divided and regulated that each obtains the necessary amount and no more. As the proportion of volatile matter in the coal increases—in some classes it is over 30 per cent. by weight—the furnace efficiency usually decreases, and the usual practice of basing fuel contract prices merely on the apparent calorific value without restriction as to the volatile content is open to adverse criticism. Contracts based on the calorific value with 5 per cent. reduction in price for each 1 per cent. increase in volatile matter over an agreed maximum are more advantageous to the consumer, and where low volatile fuels, natural or artificial, are obtainable at reasonable cost, improved results should be obtained by their use. The nearer a fuel approaches in composition a simple compound of carbon and ash, the easier becomes the process necessary to realise its full "potential."

**E. W. L. N.**

### The Association of Mining Electrical Engineers.

After reading your leader of November 21st, I looked forward to the "slating" you would get from the A.M.E.E. in your next issue. However, you didn't, due to the fact that there is not a member in the whole of that illustrious body in a position to do so. Your article truthfully exposes the state of affairs prevailing to-day, which is exactly what it was before the inception of the A.M.E.E. During the early canvass for members I was handed a copy of the rules and aims (*sic*) of the Association, and asked to become a member, but after a few pointed questions, *re* the qualifications necessary, the classification of members, and the means to be adopted to attain the objects set forth, I decided to deny myself the "honour."

In your reply to Mr. Hall you quote the argument I have expressed scores of time against becoming a member. About a year ago I attended a lecture organised by a branch of the Association to mine managers and electricians, and listened about two hours to some piffle about Arago's disk and Oersted's experiments, after which questions were asked, and I innocently said something practical; this immediately brought a request from a member of the audience for further information, which was endorsed by the chairman, subject to my qualifications being in order. On inquiring what these were, I was informed that to become a member cost two guineas.

For about seven years my business has brought me into constant touch with colliery electricians and engineers, during which time I have carefully watched for any signs of improvement in the status or the capabilities of electricians-in-charge, but in vain. In your article *you* deal with the tragic side of the question, but must realise that to men who make money out of this state of affairs it offers scope for considerable merriment. Here is a case from hundreds I alone could supply. The traveller sold a squirrel-cage motor and auto-starter, with a centrifugal pump. This was put to work without a gate valve in the delivery side and was found to operate very unsatisfactorily; therefore, when the traveller called again he suggested a slip-ring motor and rotor starter, got the order and then told the story in the commercial room.

**F. W. A.**

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I have been an interested reader of the correspondence on the above Association, and had hoped to contribute a few more or less rambling remarks to this discussion. It, however, appears that if one dares to breathe, or write, a word of criticism against this most important body one cannot do so without being accused of "having a grievance" against it.

I, therefore, content myself by sending you an extract from a letter I received on the 13th inst. from a member of three or more years' standing. The extract I quote is a casual paragraph in a letter dealing with quite a different subject.

"The A.M.E.E. is not much good now. There is more than a little trouble amongst the members owing to the large number of managers and their pet men the engine-wrights. You dare not say anything at a meeting or else you get sat on afterwards for it. The manager's clique sits round the table with its back to the electricians, who sit silent behind."

It would appear that many members "have a grievance" as the managers make it unpleasant if the electricians do not join the Association, do not attend the meetings, and say anything if they do attend.

**Nemo.**

London.

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### Asbestos Insulation.

We notice in your issue of December 5th an article on Aluminium Insulation for Magnet Coils, in which the writer points out that "When higher temperatures have to be withstood, asbestos coverings have sometimes been adopted, but only at great sacrifice of space," and goes on to say that even a small wire requires a radial thickness of asbestos of about ·35 mm., while the corresponding thickness in double cotton covering is only ·1 mm.," and so on.

We take the liberty of pointing out that for some year

we have now placed before electrical engineers our Asbestin Copper Wire, and enclose a pamphlet giving some particulars of this wire, also a sample by which you will notice that the asbestos insulation on this wire is put on in so compact a manner that the space taken up is not more than that of an ordinary double cotton covering, and the radial thickness of covering in No. 33 G. wire, for example, is only ·1 mm.

This is the only asbestos-covered wire on which the covering does not take up any more space than it would do in the case of an ordinary cotton-covered wire.

**The Concordia Electric Wire Co., Ltd.,**
R. Fifer, *Director.*

London, N.W., *December 12th*, 1913.

[Tests that we have applied to the sample show that the insulation withstands a very high temperature.—Eds. Elec. Rev.]

### Electric Clocks.

Will you allow me to say a few words of comment on Mr. Hope-Jones's letter *re* electric clocks?

The "Hipp" pendulum as used in the "Silent" system, notwithstanding the "powerful switching operation," is a very good timekeeper. If it were not nearly so good in this respect, I should still consider it excellent for all practical purposes, because of the mechanical and electrical goodness of the contact arrangement, but as clocks of this type have been found to go as near as 1 second per week, the horological objections are more academic than practical.

The K.R. conditions of the circuit can, in the Synchronome system, have control of contact duration, but that is not to say that this control extends to the mechanical action of the clockwork in the individual dials—the margin of safety to cover this is necessarily arbitrary.

After some years of experience, I am convinced that nothing is more undesirable in any clock than an ultra-rapid actuation of any part. It is a question of avoiding undue wear and tear, and of giving liberal opportunity for correct functioning of all parts at all times.

I am in full agreement with Mr. Bousfield *re* Mr. Hope-Jones's services in the development of electric time service.

**G. B. Bowell.**

Margate, *December 15th*, 1913.

Your correspondent, Mr. Hope-Jones, sets forth certain principles underlying the operation of electric clocks, and as he admits there is room for difference of opinion in the practical working, it may be my excuse for detailing some divergence from his opinion.

Regarding the Hipp-Foucault method of pendulum-driving, Mr. Hope-Jones states that the amplitude of oscillation is perpetually varying with irregular frequency. This, however, is not the case in practice. It is true that the arc must fall to allow the re-energising contact to be closed, but this is so slight that it is almost invisible upon a degree scale shown at the termination of the pendulum. If the frequency of the impulses is arranged so that they occur at intervals of not more than five seconds' duration, and provided that the design of the pendulum has been properly carried out, no more ideal mode of driving could be obtained, and the disturbance of the natural rate is extremely small. Contrasted with the gravity arm drive, where a heavier thrust is given to the pendulum every 30 seconds, and the arc considerably increased thereby, much is apparent in favour of the Hipp method. This is further borne out in practice by the fine performances of Hipp-driven pendulums, both as regards time-keeping and reliability, even when doing the work of periodically closing contacts for secondary dials. If the contact is closed while the pendulum is in the zero or middle position, and the contact gear is so arranged that any power absorbed by springs is returned to the pendulum, the disturbance is very small; in fact, the work is little greater than the release of a latch holding a gravity arm where the power is not regained.

The limitation of the duration of contact when the current has attained the summit of the inductive wave is a matter of importance only where the power is supplied by primary cells. Where plenty of current is available, the contact may be left sufficiently long for the whole of the dials to operate without undue absorption of power. In battery working, it is easy to adopt a device which will automatically cut off the current when it has reached full strength.

**H. Bevan Swift.**

London, E.C., *December 15th*, 1913.

### Code Books for Engineers.

Replying to Mr. D. Eardley McLaren's letter in your issue of December 12th, there exists one published code which contains all ordinary commercial and also electrical engineering matter. The code in question, notwithstanding it has been recommended by the British Electrical and Allied Manufacturers' Association, is too little known, owing to the fact that it has not been advertised. Those firms who have heard of it employ it, one engineering firm having 20 copies in use.

The author has had 25 years' practical experience in compiling codes, and has almost completed a more extensive work embracing still more technical and electrical engineering matter. But the fact is, it is a question of support or remuneration, and it only requires the co-operation of the B.E.A.M.A. or others to bring about the publication of what should become a standard work.

But to return to the code already on the market. This book contains commercial phrases combined with "voltage, phase, cycles, speed, candle-power, type of motor, coupling, efficiencies, and the hundred and one other important detail matter" called for by Mr. McLaren. I fear no other published code could cope with the example given by him, even in any number of words. In eight words the book in question will code:—

Quote price f.o.b. and c.i.f. motor-generator D.C. compound-wound 18 point 00 KW., 100 volts, compounded 15 per cent. higher, shunt regulator, not to exceed 900 R.P.M., motor A.C., three-phase, 100 cycles, 400 volts, starter.

And in two and a half words the supposed reply:—

Price of plant complete £319, £378, ready for shipment in 25 working weeks from date of full particulars.

If the above code is not sufficient for any engineering and electrical firm, I should be happy to co-operate in producing the more extensive code mentioned in the second paragraph above.

**C. H. Cole.**

Rugby, *December 15th*, 1913.

### A Question of Terms.

I might point out that the most likely answer to the query of your correspondent of December 5th concerning the relative values of the terms "fool-proof" and "mistake-proof" appears to be contained in the pages of your contemporary the *Electrician* for July 25th last, where it has been noted in this connection that "a fool is among all men the most sensitive as to his shortcomings." Hence we may suppose that the American, in his courtesy crusade, one among the many startling movements for which the electrical community of that nation has recently become famous, coined the word "mistake-proof" to save the face of the potential purchaser of such apparatus to which the name applied.

**An Observer.**

*December 9th.*

**Trade with the United States.**—We have received a copy of the prospectus of the Merchants' and Manufacturers' Exchange, a United States corporation which is stated to be a clearing house of merchandise of almost every description, and which, by special Act of Congress, is enabled to receive imported goods duty free into its head establishment, the Grand Central Palace, New York. There the goods will be displayed for sale in a building visited by vast numbers of prospective purchasers, and duty is only payable when the goods are actually sold. Such a warehouse is considered to afford an excellent opportunity for British firms who want to get their electrical and engineering wares known in the American market. We are informed that Mr. M. S. Mannes and Mr. Lee Kolpman, the vice-president of the Exchange, and the secretary of the Sales Syndicate (a department of the Exchange) respectively, are now staying in London (Savoy Hotel) in connection with their tour of industrial centres in Europe.

## VARIABLE SPEED "CASCADE" WINDERS ON THE RAND.

A Rand Correspondent informs us that two winders which embody several novel and interesting characteristics have recently been installed underground at the Van Ryn Deep Gold mines in South Africa.

These winders have been supplied by Messrs. Sandycroft, Ltd., of Chester, and are of their patent variable speed "Cascade" design suitable for two constant synchronous speeds, *i.e.*, 500 r.p.m. and 333 r.p.m., while at the same time capable of giving any intermediate speed between these mentioned and zero, with a uniform torque throughout.

The motors have a normal rating of 700 b h.p. and are capable of developing 2½ times full load power; they are supplied from the Victoria Falls Power Co.'s mains at 2,000 volts 50 cycles.

The motors drive the main drums through single reduction gearing, and the plant is placed underground at a depth of 2,000 ft. so as to deal with the incline section of the Van Ryn Deep hoisting system. The gradient of these inclines varies from 12° approx. to 42° approx., which necessitates varying the winding speeds at certain points, which can be carried out most advantageously by either the Ward-Leonard or "Cascade" systems, so as to obtain a maximum efficiency and ideal working conditions; the maximum winding speed required is 2,500 ft. per minute.

The system of control is simple, the whole operation being controlled from the driver's platform by means of one lever. The first motion of this lever in either direction controls the motor operating the oil reversing switch; a further movement of the lever operates a valve on a small air engine which, in turn, operates the controllers. The position of the valve is in accordance with the speed required. The controllers for each winder are of the Sandycroft patent screen type, and are divided into two units, one regulating the stator circuit and the other the rotor circuit. Both controllers are operated in turn by the full stroke of the common air engine on the up-going stroke, and *vice versâ* on the down-going stroke.

The sequence of events is as follows:—In connection with the operation of the controllers by the air engine, the stator controller is first operated, the slate screen being lifted and so exposing a certain amount of plate area according to the speed required; the screens are eventually lifted the full amount and expose the full plate, so bringing the motor up to full "Cascade" speed, the driver's lever being pushed on to "Cascade" speed position.

The lever being pushed forward beyond this position, allows the up-going stroke of the air engine to continue; the screens of the rotor controller are then raised and the stator screens lowered, until at the end of the stroke the rotor plates are fully exposed and the stator plates are again covered; this allows the motor to run at top speed.

It is interesting to note that during the process of slowing down from top speed to "Cascade" speed, current is being generated, hence such winders can always be braked down to two-thirds speed on the regeneration system. With reference to the general principles of the variable-speed "Cascade" motor, we would refer our readers to the paper read by the inventor, Mr. L. C. Hunt, before the Institution of Electrical Engineers and to the papers read by Mr. M. I. Williams-Ellis before the A.M.E.E. and S.A.I.E.

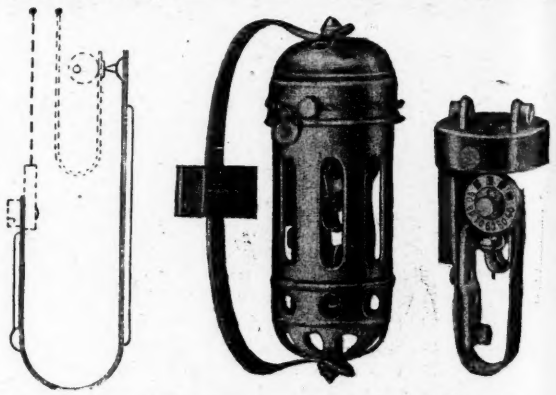
**Diesel Engines.**—Referring to the recent correspondence respecting Diesel engines in our pages, Messrs. R. S. Price, Ltd., of Amberley House, Norfolk Street, W.C., send us particulars of the "Maihak indicator and Bottcher power counter." Over 7,000 of these instruments have been sold, the purchasers including the following well-known Diesel engine builders:—Sulzer Bros., 170 apparatus; C. and T. Pattison, 120 apparatus; Diesel Engine Co., 108 apparatus; Fried-Krupp A.G., 86 apparatus; Korting Bros., 78 apparatus; Franco Tosi, 41 apparatus; M. A. N. Augsburg, 60 apparatus. Messrs. Price do not understand Mr. C. J. Wood's expression "blast-recorder" as applied to Diesel engines, but if the same signifies "pressure recorder," they regret that the invitation to which he refers was not extended to them.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Automatic Fire Alarms.

The Siemens & Halske Co., of Berlin, have recently introduced two distinct types of electric fire alarms to meet the practical conditions which occur most frequently.

The first form (maximum temperature alarm) is shown in fig. 1. It consists of a U-shaped metal strip, formed of two strips of materials of different expansion coefficients welded together. When a temperature rise occurs the unequal expansion causes the strip to bend up, and so either make or break a contact, as desired, at some definite predetermined temperature. This temperature can be varied between 40° C. and 90° C. by means of a graduated



Figs. 1 & 2.—Expansion Strip and Complete Maximum Temperature Fire Alarm.

wheel. Fig. 2 shows the alarm in its complete state, with its perforated outside protecting case. The whole is arranged for suspension by means of a spring clip from the wall or ceiling of a room.

The second type (differential alarm) is shown in fig. 3. It consists of a glass U tube, each arm of which is about half filled with mercury, over which a small quantity of a volatile liquid is placed. One limb is composed of thicker glass than the other, so that when a rapid rise of external temperature occurs, the heat penetrates much more slowly into the thick glass limb than into the other. The liquid in the thin glass limb will, therefore, be vaporised first, and the excess of pressure so produced will cause

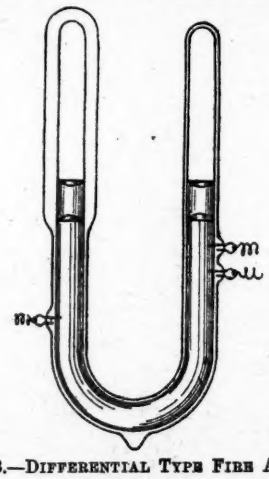


Fig. 3.—Differential Type Fire Alarm.

the mercury to fall in that limb, and, as soon as the drop is sufficient, the mercury contact between two platinum wires sealed into the glass will be broken, and this serves to give the alarm.

The dimensions are so chosen that ordinary temperature variations produce no effect, but any exceptionally rapid rise of temperature, such as occurs at most fires, will at once be notified. Occasionally, *e.g.*, in the case of spontaneous combustion, a fire occurs with only a slow rise of temperature, and in such a case this differential alarm would possibly fail to act, and, to meet such cases, an alarm of each form (maximum and differential) is sometimes made up in a single frame.

Besides the alarms themselves, the apparatus includes an indicator-board at the fire station, by which the locality of the fire is shown, and the necessary testing instruments.—*E.T.Z.*

### Ediswan-Zenith Sign.

The Edison and Swan United Electric Light Co., Ltd., Ponder's End, Middlesex, have recently acquired the manufacturing rights of the "Ediswan-Zenith" Light Saving Sign (Beville's patent).

The lamp is fixed between distributing screens, while its side rays are thrown on to mirrors at either end of the sign, by which arrangement, an even distribution of light over a large surface is obtained. In the case of either single or double sided signs the width of the containing box is reduced to the absolute minimum, thus offering extra facility from a decorative point of view.

The arrangement is applicable to facias, projecting signs, window signs, wall signs, and, in fact, to all signs illuminated from within.

### New Bastian Heaters.

A new heating element, called the "Rodolite" glower (fig. 4), has been introduced by the Bastian Electric Heating Syndicate, Ltd., 185, Wardour Street, W. The 10-in. glower is interchangeable with the Quartzalite glower, and is made of 250 watts

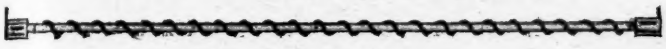


Fig. 4.—Rodolite Glower.

capacity, for all voltages from 25 to 250 volts or more. The spiral seen in the figure is of Tabasco alloy, and has a thin thread running through it, which binds it in place. When the glower is switched on, the thread is burnt off, and the spiral takes a permanent set in the correct position.

Fig. 5.—Heater with Rodolite Glowers.

The "F" type heater case shown in fig. 5 is of 2-kw. capacity, and is used with the "Rodolite" glowers; the capacity is increased by one-third, compared with the "Quartzalite" apparatus, and the price has been reduced.

### A New Lock-nut.

A new lock-nut, known as the "Perfloc," has lately been introduced by the Engineering Improvement Co., Ltd., of 39, St. James Street, London, S.W., which combines the functions of a nut and locking device, consequently doing away with the usual second nut and split pin. The feature of the "Perfloc" nut is the simple yet ingenious method by which the self-locking action is secured. The nut itself is of standard form and thread, but a size larger than the bolt, in order to allow a spiral spring to be em-

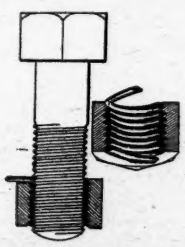


Fig. 6.—The Perfloc Lock-Nut.

bedded in the thread of the nut. One end of the spring is firmly fixed in the base, while the other is left free, and projects slightly beyond one of the faces of the nut, a slot being cut on the latter to accommodate the free end so that it does not jamb on the face of the washer against which the nut bears. The spring is of a special diamond section, so that, in reality, its inner surface becomes the actual thread of the nut; the latter is screwed on to the bolt in the customary manner, locking itself automatically and instantaneously in position, all tendency for the nut to slacken, under even the greatest vibration, being arrested by the binding of the spiral-spring thread on the bolt.

An important characteristic of the new nut is that the action is such that, whilst under no circumstances can the nut slack back, it has an automatic tendency to tighten itself up against the plate or other part which it is maintaining in position, this tendency increasing with the intensity of vibration. The removal of the nut, notwithstanding its tight grip of the bolt thread, is quite a simple matter, it being only necessary to apply a slight pressure to the free end of the spiral-spring thread, which releases the binding action of the latter; it is then possible to turn back the nut by hand as long as the pressure is maintained.

The "Perfloc" nuts have been subjected to a variety of exhaustive tests, by which the claims with regard to the non-slackening qualities and absence of wear even when under trying conditions have been fully sustantiated. The new nut, both as regards strength and freedom from liability to damage by rust, is fully equal to that of the ordinary form, and there are no saw-cuts or holes in the nut by which dust or grit can enter to interfere with its action.

### Double-Pole "Igranic" Remote Control Circuit-Breaker.

This type of circuit-breaker forms an integral part of many "Igranic" starting switches and controllers, with which it is interlocked in various ways; it is also suitable for independent use, and is made by the Igranic Electric Co., Ltd., of 147, Queen Victoria Street, London, S.W.

The current-carrying contacts consist of a laminated phosphor-bronze brush pressed against a hard rolled metal surface. This construction eliminates the danger of partial contact, for whenever contact is made at all, it must be over the whole surface area.

Furthermore, the contacts are always clean, because each time that the switch closes the flat contact surface is slightly scraped by the edges of the leaves of the laminated brush as they expand.

Fig. 7.—Igranic Remote-Control Circuit Breaker.

These current carrying contacts are reinforced and protected by easily renewable circuit-breaking contacts of carbon of large size, and so disposed as to always make contact before the metal contacts and break after them.

As will be seen by reference to the illustration, the pole-pieces of the blow-out magnet swing up to permit easy inspection of the contacts.

### Variable-Speed A.C. Motors.

Messrs. H. W. Butler & Co., of Craven House, Kingsway, are introducing a line of A.C. motors with a wide range of speed. These

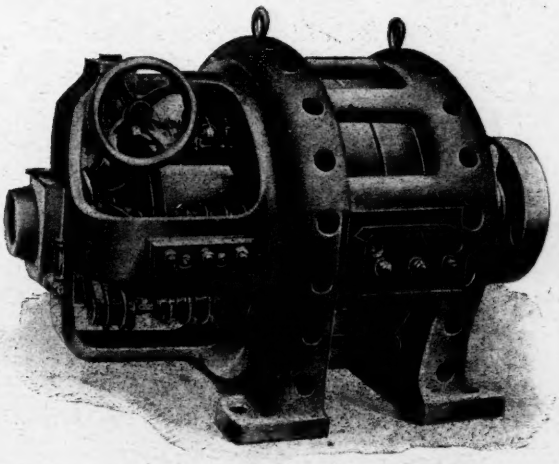


Fig. 8.—Latour Three-phase Variable speed Motor.

machines are made on the Latour system, with commutators, both single and polyphase, and run at speeds variable in the ratio of

1 : 3 ; all sizes are manufactured from ½ to 300 H.P. The single-phase motors are of the series type ; the polyphase motors have an ordinary three-phase stator and a D.C. rotor with three sets of brushes spaced 120° apart. Both stator and rotor are supplied with current from the three-phase mains, producing two magnetic fields rotating at synchronous speed ; the two fields are in phase with regard to time, but not in space unless the brushes are in a particular position on the commutator. If the brushes are shifted the fields are correspondingly displaced in phase, but produce a couple depending upon the angle of displacement, and thus affecting the speed of the rotor. The speed can thus be economically regulated over a wide range, and the motor can start with a large couple, without any loss of energy except that due to the ohmic resistance, &c., of the machine. It is claimed that high efficiency and high power factor are other advantages possessed by these motors.

The rotor is connected in series with the stator, except when the supply pressure is too high for the former, in which case a transformer is employed for the rotor currents. Speed regulation is

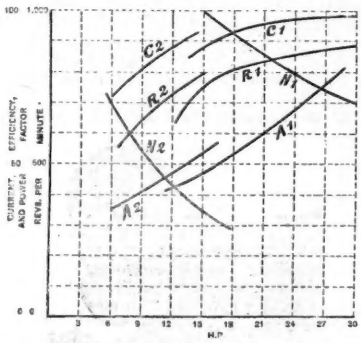



Fig. 9.—Characteristics of Latour Motor.

effected by shifting the brushes with a handwheel and screw. Special windings adopted for the rotor on the Latour system render commutation sparkless over a range of speeds of 1 : 3. The motor behaves like a D.C. series motor when the brushes are left stationary, but racing on light load is prevented by a patent method involving the use of an air-gap in the transformer supplying the rotor.

Fig. 8 shows a 27-H.P. three-phase motor for 220 volts, 50 cycles, intended to drive a feed pump, and capable of running at any speed from 350 to 750 R.P.M. Fig. 9 shows the characteristics of this motor with the brushes set for 750 and for 350 R.P.M. at normal torque ; $A_1$, $A_2$ are the current strengths, $B_1$, $B_2$, the efficiencies, $C_1$, $C_2$ the power factors, and $N_1$, $N_2$ the speeds.

Motors for driving textile machinery are also supplied by the firm. They are totally enclosed, and ventilated by a current of air

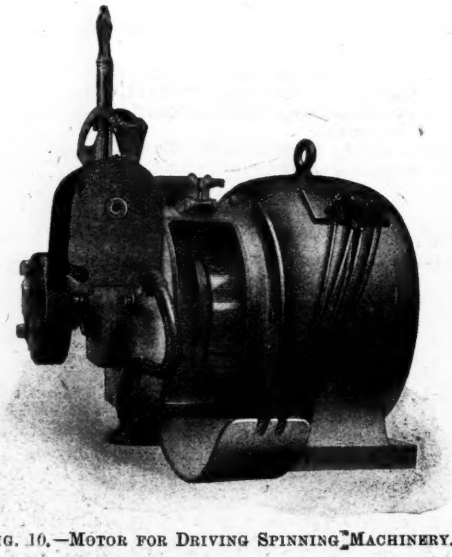


Fig. 10.—Motor for Driving Spinning Machinery.

drawn through a duct. Fig. 10 shows one of these motors, with the controller for starting and regulating the speed mounted on the cover ; on opening the circuit the brushes are automatically returned to the position of lowest speed. The motor illustrated gives 8·5 H.P. at 900 R.P.M., falling to 5·5 H.P. at 600 R.P.M., and is built for 110 volts, 25 cycles. The efficiency between these limits remains at 80 to 85 per cent., and the power factor varies between 0·85 and 1. A large number of these motors has been supplied to various Continental firms.

## Relay-type Crane Panels.

Mr. George Ellison, of Warstone Lane, Birmingham, has supplied a number of relay-type crane panels, which are doing excellent service on steel works and wharf cranes.

One of these panels for a three-motor direct-current crane is illustrated in fig. 11.

The general scheme consists of an automatic circuit-breaker (controlling the whole of the supply to the crane), fitted with loose handle feature and overload and no-voltage releases : each motor of the crane is provided with a patent time-limit overload relay adjustable between 20 per cent. overload and about 100 per cent. overload, and also adjustable for the time of retardation of

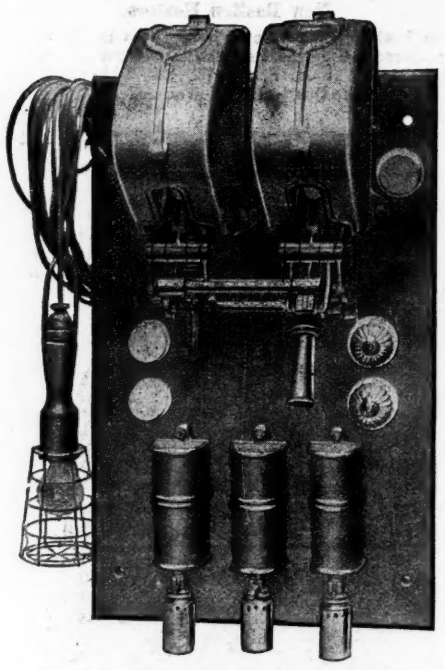


Fig. 11.—Relay Type D.C. Crane Panel.

operation, that is, having 11 different settings on the time lag, giving any desired retardation between three seconds and five minutes.

The relays are of the solenoid type, and open the main circuit-breaker when a motor is overloaded ; the breaker can be replaced without the delay associated with fuse renewals.

A hand lamp with flexible and tumbler switches, are provided on the panel, which conforms with the Home Office Regulations.

Fig. 12 shows diagrammatically a panel for three three-phase slip-ring A.C. motors, equipped with a main three-pole circuit-

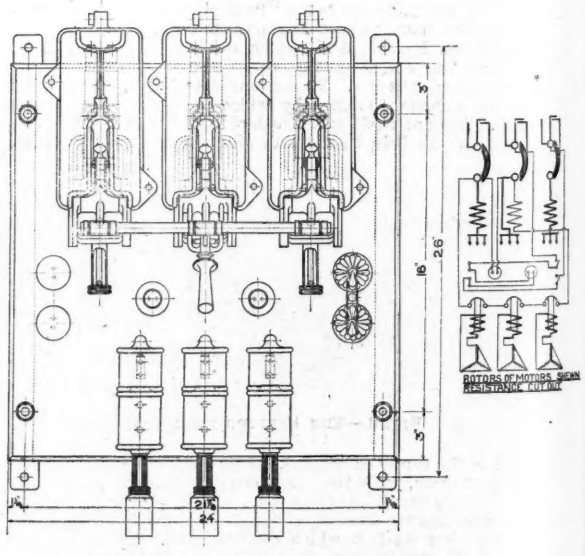



Fig. 12.—Relay Type A.C. Crane Panel.

breaker, controlling the stator circuits of the motors and fitted with no-voltage and two overload releases ; one time-limit overload relay for each motor, connected in the rotor circuit ; pilot lamp, flexible, &c.

The placing of the overload relays in the rotor circuit not only gives protection against overloads, but also against the failure of supply in one phase only, with which in the ordinary way a motor continues to run, with exceedingly heavy induced currents in the rotor windings

### Seymour Patent Tire.

One of the most important questions in the management of a railless trolley system is the life of tires; in the ordinary way a resilient tire has a short life, while a tire designed for durability is hard and unyielding. The two qualities of resilience and durability have been ingeniously combined in the "Super-resilient" band tire recently introduced by the St. Helens Cable and Rubber Co., Ltd., of Warrington, for heavy vehicles. The special feature of this device is the insertion between the hard tread rubber and the steel band, of a layer of specially pure, soft and

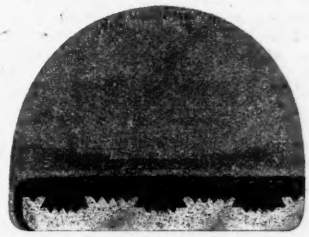


Fig. 13.—Section of Seymour Patent Tire.

resilient Para rubber, which absorbs road shocks and relieves the tread rubber of the deleterious effects of hard usage. This resilient layer can be seen in the section shown in fig. 13.

This tire, we are informed, retains its shape under a load, does not break out at the sides, does not overheat, and possesses 70 per cent. greater resilience than the ordinary type of tire.

### Porter Patent Safety Seal.

The Porter Patent Safety Seals, Ltd., of Belfast Road, Stoke Newington, N., have introduced a lead seal which it is claimed cannot be tampered with by the outsider without detection. It consists of a leaden sleeve, a small flat piece of lead, pierced by two parallel holes, to allow it to be slipped over the ends of the seal wire, as shown in fig. 14; the wire being threaded, the lead

Fig. 14.—Lead Sleeve on Wire.

Fig. 15.—Finished Seal.

is crushed into a zig-zag between the jaws of a small sealer, and impressed with the name of the Corporation, &c., as in fig. 15. The sealer, which is only 5 in. long and 6 oz. in weight, can easily be carried in the waistcoat pocket; it is of spring steel, nickelled and well finished, and is shown in fig. 16. The jaws impress upon the seal 20 letters, five on each angle, and when crushed the lead assumes a sharp zig-zag form, therefore the zig-zag crush and

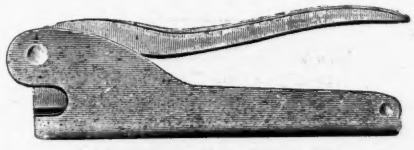


Fig. 16.—Sealer for Safety Seal.

impress claims to be the most efficient seal upon the market, as it cannot possibly be tampered with unless detected immediately. The arrangement is simple, effective and economical. In addition to many electricity works, it is now being used by the British and Colonial Post Offices, Civil Service Commissioners, Foreign and Colonial Offices, British Embassies and Legations, British and foreign railway companies, mints, banks, &c.

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**Fire.**—We have received the following note:—"The chemical laboratory of the St. Helens Cable and Rubber Co., Ltd., was burnt down on Sunday night, the 7th inst., but luckily without damage to the rest of the premises. Careful investigation proved that the suffragettes had nothing to do with it."

## LEGAL.

Grant Finance Co., Ltd., *v.* The Victoria Falls and Transvaal Power Co., Ltd.

As briefly mentioned last week, Mr. Justice Pickford, on December 9th, delivered his reserved judgment in this action heard before him on November 19th and 20th, in which the plaintiffs claimed to recover from the defendants certain monies as assignees of an agreement of April 26th, 1907, made between the defendants and Mr. Montague Fullerton Armstrong, an engineer, the claim relating to receipts received by the defendants as to the supply of electrical current to certain mines on the Rand.

Mr. Gore Brown, K.C., Mr. Norman Craig, K.C., M.P., and Mr. McCardie appeared for the plaintiffs, and Mr. Levett, K.C., Mr. H. F. Dickens, K.C., and Mr. G. H. Allen for the defendants.

The case related to a long and complicated agreement, and involved questions as to the plaintiffs' rights to have commissions on money received by the defendants for electrical supply, from various Rand companies and mining groups, but the substantial questions were whether any receipts from the group of Eckstein were subject to the agreement, whether the Eckstein group were being supplied by the defendants' works, and questions were also raised as to whether plaintiffs were entitled to commission on renewals of contracts.

The defendants said they had paid the commission due in respect of certain groups, but they had not paid for the Eckstein group as they said Mr. Armstrong got no contract from the Eckstein group, it being obtained by a Mr. Harper, who was paid a considerable sum for it. They said the Rand Mines Power Co. was formed by them to supply the group, and they could not be regarded as the assignees of the defendants. Mr. F. Eckstein had given evidence for the defendants that he refused to consent to the Victoria Falls Co. supplying the Eckstein group with electrical power. Lord Winchester, chairman of the defendant company, had also given evidence.

Mr. Justice Pickford said that in this case the plaintiffs claimed to sue as the assignees of a Mr. Armstrong to recover certain remuneration or commission alleged to be due to Mr. Armstrong under an agreement between him and the defendants, and a number of questions arose in connection with which various declarations were asked for by the plaintiffs. It appeared that Mr. Armstrong was employed by a syndicate called the South African Concessions Syndicate, which promoted the defendant company to perform certain work or get arrangements by which the syndicate and the company it promoted were to supply electrical power to mines and other undertakings in the Transvaal, entirely, he understood, on the Rand. Mr. Armstrong succeeded in doing a very considerable work for the syndicate, and when the defendant company was promoted there arose the necessity for arranging Mr. Armstrong's rights of payment. The agreement of April, 1907, was ultimately entered into, and it recited among other things that Mr. Armstrong would be entitled to receive from the company various sums of money in respect to his services and that he should receive certain shares. An important provision was that for 25 years from January, 1907, there should be paid to Mr. Armstrong or his assignees sums equal to 2½ per cent. on the gross receipts obtained by the company for the supply of electrical power to certain corporations and companies and undertakings, and there was a question raised in the case as to whether the mines forming the Eckstein group came under the agreement. At the time the agreement was made, his Lordship thought both the defendants and Mr. Armstrong were of opinion that—whether there was a signed contract or not—they had in fact obtained the opportunity of supplying the Eckstein group with electrical power. By the 11th Clause it was provided that for 25 years from January, 1907, Mr. Armstrong should have a sum equal to 1¼ per cent. on receipts obtained by the company for the electrical supply to a number of Corporations, and the list included the municipality of Johannesburg and Johannesburg Consolidated Investment Co., Ltd., and the group belonging to or controlled by them. The case for the plaintiffs was that the defendant company by itself or by its assignees had supplied electrical power to the Eckstein group, and the defendants replied that it was not supplied either by themselves or their assignees, and, therefore, it did not come within the clauses of the agreement. The defendants said that neither they nor any of their assignees had the right of the supply, nor had they received the gross receipts in respect to such supply. In respect to the Rand Mines Power Co., the defendants held the shares, and it was said that they could do what they liked with it, and that their supply to the Eckstein Group was a supply by the defendants or their assignees. On this point he saw no reason for not accepting the evidence of Lord Winchester, chairman of the defendant company, and of Mr. Eckstein, that Lord Winchester did *bona fide* try to get his company accepted as the supplying company, in which event they would have paid the commission, and he had no doubt that Mr. Eckstein declined to consent to the defendant company supplying the power. It seemed to his Lordship that he was bound to say that this was not a supply by the defendants, although they did hold the whole of the capital of the supplying company, and he was also bound to hold that it was not a supply under the circumstances by that company as the agents of the defendants. Therefore, it could not be held to be a supply by assignees of the defendants. It had been argued that they were assignees of the defendants, because they were the assignees of buildings built by the defendants in which the power was generated, but it did not seem to his Lordship that there was ever a contract by which the defendants had the right to supply, or the

right to receive the gross receipts of the supply of, electrical power to the Rand Mines. Therefore, on that chief point in the case the defendants were right and must have judgment. In regard to Clause 12, that related to all contracts existing in 1907, relative to certain bodies, he thought the contention of the plaintiffs also failed, but under Clause 11 that provided for a percentage payment on gross proceeds received by defendants or their assignees obtained by supplying certain specified corporations, including the Johannesburg Investment Co., for a period of 25 years, he thought the plaintiffs succeeded, and were entitled to a declaration accordingly. In regard to the contention of the plaintiffs that where there was a contract with any one mine comprised in a group, they were entitled for 25 years to the commission on the receipts for supplying all the group, or that if they got one company they got the whole, he did not think the contract supported this, as each group was not spoken of as a company or undertaking. It might have been intended as the plaintiffs had submitted, but he could only say that it did not seem to him that the contract said so, and he had to go by the contract, and on that feature of the matter he upheld the case for the defendants. Therefore, on the whole of the case his decision was for the defendants except as to the commission upon the continuous or discontinuous supply under Clause 11. This meant he presumed that the defendants substantially succeeded in the action.

Mr. Norman Craig, K.C., said he took it his Lordship would make declarations putting his judgment into effect.

Mr. Justice Pickford said counsel could draw up the declarations accordingly. The effect of his judgment was that defendants had succeeded on all points except one, as to which the plaintiffs had succeeded.

His Lordship said that as to the costs, the ordinary course would be for the parties to have these on the issues in which they had succeeded, and he thought there had better be a set-off on these lines.

Mr. Norman Craig said the parties to the action were both substantial, and it might be desired to take the opinion of the Court of Appeal, and he therefore asked for a stay.

Mr. Justice Pickford: Yes; give notice in 14 days.

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### The Sunderland District Electric Tramways *v.* The Newcastle-upon-Tyne Electric Supply Co. and the County of Durham Electric Power Supply Co.

In the Chancery Division, on December 10th, Mr. Justice Sargant had before him this action, by which the plaintiffs sought to establish their right of having from defendants a supply of electrical energy for the working of their tramway upon the terms of an agreement of January, 1905.

Mr. Mark Romer, K.C., and Mr. Percy Wheeler appeared for the plaintiffs, and Mr. Martelli, K.C., and Mr. Gibson for, the defendants.

In opening the case, Mr. Romer said that the plaintiffs, by their statement of claim, asked for a declaration that they were entitled to a continuance of a supply of electrical energy on the terms of an agreement of January 30th, 1905, and for an injunction to restrain the defendants from cutting off or discontinuing the supply of energy during the term of the agreement. The plaintiffs further asked for a declaration that they were entitled to a right of set-off, but he did not think that any question would arise between the parties as to that, for if the plaintiffs were right in their contention on the first point, he did not think that there would be a contention that they were not entitled to an adjustment of the account by way of set-off. The point between the parties was as to whether the agreement referred to was, under the circumstances, binding on the defendants, the Newcastle-on-Tyne Electric Supply Co., as being an agreement that was entered into, as it was entered into not by them, but by a company called the Durham Collieries Electric Power Co. It was an agreement by the Durham Collieries Co. to supply the plaintiff company with the electrical energy necessary to run their cars. The Durham Collieries Power Co. went into liquidation, and a Receiver was appointed in an action brought by a debenture-holder to enforce the debenture security. All the assets, with practically all the assets and undertaking of that company, were sold to the defendants, the Newcastle-upon-Tyne Electric Supply Co., but they said that they were not bound to carry out the agreement in question. If it turned out that they were right in that contention, counsel did not think that they would be unwilling to supply the plaintiff company with energy, but the price the plaintiff would have to pay would, no doubt, be considerably larger than the price agreed upon when the Durham Collieries agreed to give the supply.

His Lordship asked how the County of Durham Electric Power Supply Co. came into it.

Mr. Romer said they were the second defendants and a power company. They were authorised by the first defendants to supply electricity in bulk throughout a very large district, including the district in which these tramways were run. They had been made defendants because it was by them that this threat to cut off the electricity was made. He supposed that the Newcastle Co. had made some arrangement to take a supply from them. The history of the matter went back to 1900. It began with a provisional order made by the Board of Trade in 1900 authorising the construction of the tramway in question. It was known as the Houghton-le-Spring District Tramways Order, and it authorised the promoters to construct and maintain a tramway, and provided for the use of electric power for the purpose of running the tramway. In 1903 the plaintiff company was incorporated for the purpose of acquiring from the promoters the tramway undertaking. In 1904 a provisional order was obtained called the Houghton-le-Spring and District Electric Lighting Order, and that order was obtained for the benefit of the plaintiff company, though they were not mentioned in the provisional order as the promoters. It was an order authorising the promoters to supply electricity within the district mentioned in the order, which was substantially the district supplied by the tramways. There was in the order an express provision that the promoters should within a certain period assign the benefit of the order to the plaintiff company. The tramway company were not prepared to take the trouble of supplying the electrical energy for either of the purposes, and it was contemplated by them that the energy should be generated by another company, and accordingly the Durham Collieries Electric Power Co. was incorporated. Shortly before, or shortly after, the incorporation of the company, the agreement now in question was entered into. At the time of the agreement the Sunderland Tramways Co., Ltd., had not obtained an actual assignment from the promoters of the electric lighting order, but it was contemplated that the statutory powers would be, and as a matter of fact they were assigned shortly afterwards. The plaintiffs now having these undertakings entered into the agreement with the Durham Collieries Power Supply Co., and it was an agreement for a supply of electricity for 10 years. The rate at which the electricity was to be supplied was for the first five years ·75d. per unit, and for the remaining five years ·65d. per unit. This agreement was, no doubt, a very beneficial one for the plaintiffs, but it was intended that it should be so, for it had not provided for any payment to the Sunderland Co. for the transfer of the whole of their powers under their electric lighting order. There was provision for the payment of a royalty of £1,000 in respect of the electricity supplied from the Durham Co.'s generating station, and for special payments for electricity taken for special purposes.

At this stage, Mr. Romer announced that the parties, who had been negotiating, had come to terms. After an adjournment to enable the terms to be put in writing, counsel said that the terms were such that it would be unadvisable to mention them, but they had been put in writing and had been signed. They, therefore, asked his Lordship to make an order staying all proceedings upon the terms that had been signed.

His Lordship asked whether they would be scheduled to the order.

Mr. Romer said no, but they would be identified. There would be also an order for the taxation of costs, as part of the terms was that the plaintiffs were to pay certain costs of the defendants.

His Lordship said then the order would be to stay all proceedings in the action except for the purpose of carrying out the terms agreed, and for taxation of such costs as were payable under the agreement by the plaintiffs to the defendants.

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### Tramcar Accident Claims.

The record was closed and issues ordered in the Court of Session in an action by a Fife woman against the Dunfermline and District Tramways Co. for £200 damages in respect of injuries sustained last September. Plaintiff stated that when she started to cross the line a car was stationary, and that it was started suddenly and without warning before she got across, and she was knocked down. Defenders deny fault, stating that pursuer dashed across in front of the car before the driver could pull up.

At the Oldham County Court, on December 11th, Elizabeth Ogden, wife of James Ogden, carter, Middleton Road West, Chadderton, claimed £50 damages against the Middleton Electric Traction Co., Ltd., for injuries alleged to have been sustained through the negligence of the company's servants. The plaintiff's case was undertaken by the Carters' Union, of which her husband is a member, and an objection on the ground that plaintiff herself was not a member of the Union was upheld by Judge Spencer Hogg, who non-suited the plaintiff.

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### Edwards *v.* Brixham Gas Co.

(*Continued from page* 951.)

The Plaintiff, giving evidence in support of his case, said that directly the defendants' electrical works were started, the tenants of his cottages were continuously complaining of the vibration. In cross-examination, he denied that he had refused to let his cottages, and told applicants that they were in the hands of the Gas Co.

After other evidence as to the effect of the vibration, Mr. Hawes, electrical engineer, spoke regarding the engines used by the defendants. They were, he said, of the horizontal type, and not suitable for the position. There were others that would work with less vibration.

Cross-examined: There was nothing wrong, in his opinion, with the horizontal type of engine, and they could be worked without vibration. He did not ask whether he might go into the generating station while the engines were working, because he thought it was unnecessary. He could not say, as a matter of fact, whether there was vibration in the engine house, as he was not there while the engines were working. He did not suggest that there were any free horizontal forces in the engine at Brixham, and he should say that it had been very carefully balanced. The revolutions of the engine were 200 a minute, and he should explain the reason why some of the witnesses who had counted the vibrations put them down at 180 a minute, by the fact that some of the vibrations became absorbed.

Mr. R. Worth, civil engineer, of Plymouth, gave evidence as to the tests he had made on the plaintiff's premises for vibration. It produced, he said, sufficient oscillation on a vessel of water to cause a wave of a quarter of an inch on the surface. The vibration was such that he would not have cared to live on the property.

Mr. Matthews, consulting engineer, of Paignton, gave similar evidence and said, in cross-examination, that the plaintiff's representative offered to stop the engines four times, but that no one on the plaintiff premises would be able to say when they were stopped. He did not take the bet as it would have been sheer robbery.

Evidence was given as to the cracks found in the plaintiff's property, by architects and others who, in cross-examination, admitted that the soil was such as to be liable to subsidence.

Evidence was given by architects and house agents to the effect that vibration on the property was clearly perceptible while the defendants' engines were running, and there was no indication of vibration when they were not. The traffic in the street, even a traction engine passing, caused no perceptible vibration in the Fore Street house.

On Friday, December 12th, opening the case for the defence, Mr. McCall said that his submission would be that plaintiff had not proved that either he or anyone residing on this property had suffered in health to the smallest degree through this alleged nuisance. The serious question, however, was the position of the defendant company. The defendants had an obligation under the statute to provide electric current for the village of Brixham. The discharge of that statutory obligation necessitated the employment of an engine, and you could not get an engine without you got noise and vibration. What, then, was the defendants' duty in order to discharge their statutory obligations? It could not be put higher than this—there being an obligation upon them to supply an engine, they were bound to provide an engine in accordance with reasonable engineering skill and with reasonable engineering appliances. Admittedly, they had put in an engine which for vibrationlessness and noiselessness was an engine of the very best type that engineering skill had yet been able to produce. The plaintiff's case, therefore, came down to this—that no artificial intercepting cushion had been put between the concrete on which the engine rested and the plaintiff's premises. The evidence which he should call would show that, having regard to the nature of the soil, there was no necessity for such a cushion. Where there was silt, or a porous clay, as there was here, there was no necessity for an intercepting cushion at all, the soil itself provided the cushion. The burden of proof was on the plaintiff to show that the amount of vibration was excessive, and beyond what was necessary for the carrying out of the defendant's statutory obligations. That, counsel submitted, he had failed to do.

For the defence, Mr. Walter Bridges, consulting electrical engineer, was called. The installation of this electrical plant, he said, was carried under out under his directions. The very best type engines were used, and on his advice 200 tons of concrete was used for the bed. That, in conjunction with the soil in which it was set, would effectually prevent any serious vibration. He had been on the plaintiff's property, and found the vibration hardly perceptible. At the meeting of experts he had offered to bet the plaintiff's representatives that they could not tell when he stopped or started the engines, but they declined the bet. He found vibration in two of the cottages, but they were in a dilapidated condition.

Other evidence was given in support of the defendants' case as to the nature of the soil and the condition of the plaintiff's buildings.

On Wednesday his Lordship, without calling upon plaintiff's counsel to reply, granted the injunction.

*(To be continued.)*

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### Electric Lamp Litigation.

Mr. Justice Bankes, sitting without a jury, in the King's Bench Division on Tuesday, December 16th, concluded the hearing of an action brought by the Wolfram Lampen Aktien Gesellschaft, a German company, who are manufacturers of electric lamps with metal filaments, at Augsburg, against Mr. William J. Johns, Mr. Corbin Harris and Mr. Carl Werth, claiming to recover a sum of about £571, in respect to electric lamps supplied to the defendants between June 30th and December, 1912. The defendants denied liability.

For the plaintiffs, Mr. Colam, K.C., and Mr. MacNaughten appeared; and Mr. Pollock, K.C., M.P., and Mr. Compton Smith represented the two defendants, Johns and Harris; while Mr. Werth appeared in person.

Mr. Colam, in opening the plaintiffs' case, said the defendants had carried on business together, and the plaintiffs were suing them for lamps supplied to their order.

A number of defences had been set up, one of which was that a limited company, called the Oro Light and General Supply Co., Ltd., who had offices in London, were the persons who ought to pay, while counsel understood that Mr. Werth had stated that as he was only a guarantor, he could only be held liable if the limited company were unable to pay. The defendants, counsel said, had carried on business under the name of the Oro Light Co., and the word Ltd. was added to the title eventually. It was also said by the defendants that they were agents of the Oro Light Co., and further that on October 4th, 1911, there was an oral representation made by a representative of the plaintiff firm, named Mr. Henrich Zameczink (who was now deceased) that the lamps the plaintiffs were selling did not constitute any infringement of the patents for electric lamps held by the Osram Lamp Co.

It was the latter defence that represented the substantial body of the case. The contention of the defendants was that the representation that was made amounted to a warranty or a condition, but he (Mr. Colam) would show that this could not be sustained here, and he would also show that even if the view were taken that there was the implied warranty, there was no infringement of patent rights. He would also show that the defendants were relying on a representation that was made in connection with the negotiation of a contract that was never in fact entered into. Counsel also said that there was a suggestion of the repetition of the representation on a date that was only a few days before the end of the contract. The contract with the defendants was dated February 20th, 1912, and plaintiffs' case was that it was a clear contract of sale to the defendants personally, and as the lamps had been supplied and delivery had been taken, they were entitled to recover payment. In regard to the representation amounting to a warranty as had been pleaded, the defendants had suggested that the breach of warranty could go in extinction or reduction of the price, but plaintiffs would say that the contract was with the defendants personally, and there was no warranty that formed part of the contract. As to the suggestion of the warranty, the Courts had held that the Osram Co. were only entitled to a particular chemical method, and the plaintiffs were ready to prove—although this did not arise in this action—that their method was different and did not constitute any infringement of Osram patent rights.

Mr. Compton Smith said his clients would admit that they signed the contract in such a way as to be personally liable under it, and Mr. Werth, in reply to Mr. Justice Bankes, said that if the goods were proved to have been delivered under the agreement, he considered he could be held responsible.

Mr. Colam went on to say that the defendants had sold a portion of the lamps to third persons. He added that he took it the only question that really remained in the case was whether there was the representation alleged, amounting to a warranty set up by the defendants that could be said to apply to this contract, and the onus was on the defendants to establish this.

Mr. Pollock, K.C., subsequently argued the case for the defendants, pointing out that Mr. Johns was assured that the lamps of the plaintiffs represented no infringement of English or Canadian patents before the agreement was entered into.

Mr. Johns gave evidence that he had known Mr. Harris for many years, and it was through him that he met Mr. Werth. They agreed to go together into the business of selling the metal filament lamp. Witness spoke to the interview with Mr. Zameczink, the plaintiffs' representative, that took place in London at the offices of the Oro Light Co., and said that Mr. Zameczink stated that he could supply the defendants with lamps that would not represent any infringement of patent rights. Upon this assurance they began business, and received lamps from the plaintiffs, and then the present contract was entered into. Witness said that when in Germany he also received an assurance from a director of the plaintiff company that there was no infringement of patent rights.

Cross-examined by Mr. Colam, witness admitted that no particular patent was discussed. Witness said the Osram Co. brought an action against them for an injunction.

Mr. Colam said that when the Osram Co. began proceedings against the defendants, the plaintiffs wrote to say that they had never undertaken any obligation in England as to Osram patent rights.

Mr. Colam (to Witness): Did you attach importance to the subject of this guarantee?—Yes.

Then why was it not put into the contract?

Witness replied that they relied on the assurances verbally given to them.

Mr. Johns, in re-examination, said that some of the people to whom they had sold lamps had refused to pay.

Mr. Corbin Harris also gave evidence as to the assurance being given by the plaintiffs that their lamps constituted no infringement, and he said that plaintiffs declined to put any warranty into writing. An action was brought against the Oro Light Co. by the Osram Co., and he was the liquidator of the Oro Co. The Osram Co. got an interim injunction, and they (defendants) were ordered to destroy certain lamps. The Oro Light Co. were not in a position to defend the action brought against them.

After hearing Mr. Werth, Mr. Justice Bankes delivered judgment. He said that, in his opinion, there was no guarantee or warranty given that formed part of the contract with the defendants—what the plaintiffs did was to express their honest opinion that the lamps would not infringe patent rights. Therefore he gave judgment for the plaintiff company for the amount claimed, with costs.

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**Electrical Welding.**—A Norwegian mail steamer recently ran aground, and was afterwards taken into the dockyard at Trondhjem, where it was found that the stern-post had been broken. In the ordinary way the damaged part would have had to be replaced entirely by a new one, but it was decided to adopt electrical welding to repair the damage. The work was taken in hand at once, and after about 28 hours' stay in the dock, the ship was able to leave. If electric welding had not been employed, it would have taken at least a fortnight or three weeks to put the ship in order.

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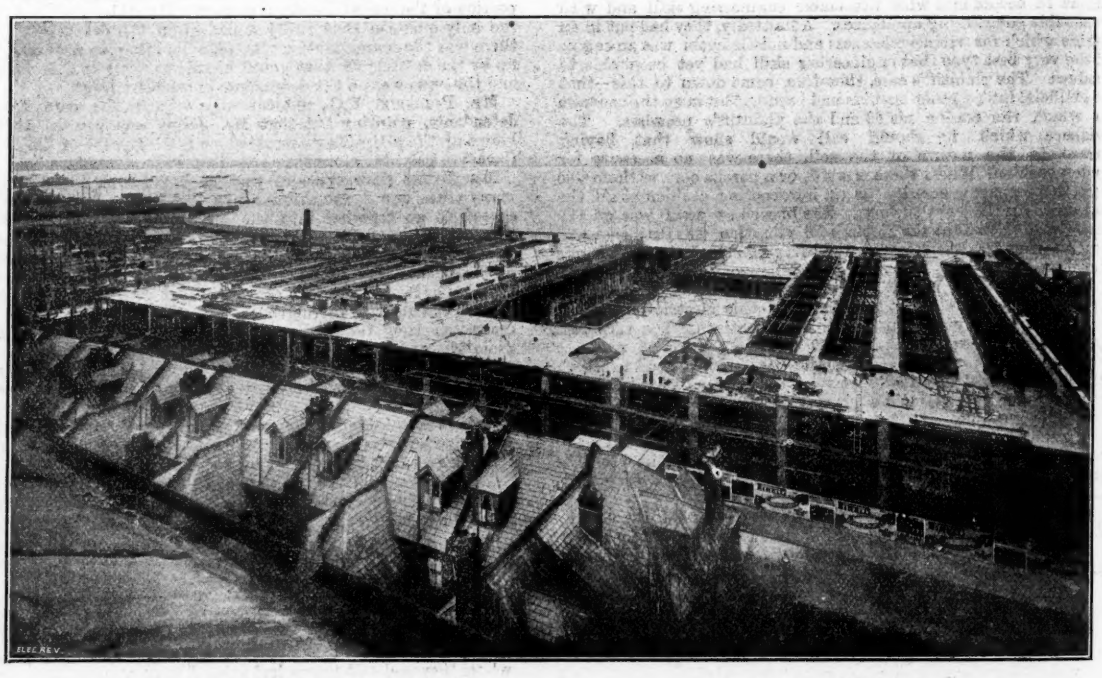
## BUSINESS NOTES.

**Battleship Lighting.**—We learn from the EDISON AND SWAN CO. that two battleships—one a Turkish boat belonging to the Imperial Ottoman Government, and the other H.M.S. *Emperor of India*, belonging to the British Admiralty—will be lighted throughout with Royal Ediswan electric lamps. Nearly 12,000 lamps will be supplied.

**Lists of Consumers.**—Referring to our recent article on lists of consumers, MR. R. B. BEATTIE, of 1A, St. James' Street, Burnley, states that he has a complete list of all consumers in Accrington, Burnley, Colne and Nelson, which he is willing to place at the disposal of manufacturers who are prepared to co-operate with him in advertising their wares.

**Cheap American Electric Vehicles.**—A company has been formed in Detroit, U.S.A., to manufacture a popular-priced type of electric motor-car. It is stated that the vehicle will be put on the market complete at £150.

**The Pirelli Works at Southampton.**—From the accompanying picture our readers will be able to see what progress is being made with the erection of the Pirelli new works at Southampton on the western shore nearly opposite the London and South-Western Station. We understand that Southampton was selected as a site on account of the shipping facilities it affords, and it is also directly connected by railway with all the principal industrial centres of the United Kingdom. The road frontage of the site is over 400 yards, and, when completed, the works will consist of 32 bays similar to those shown on the photograph, which was taken on November 20th last. At present it has been decided to erect one storey over part of the ground floor, but the foundations have been built sufficiently strong to permit of three or four storeys being added, and these will be built as required. A pier is being erected and will be fitted with an electric crane of sufficient capacity to handle with ease the various goods that will be required for the different manufactures, and it will be connected with the various stores by railway tracks over half-a-mile in length. The machinery used throughout the work will, of course, be of the latest type, electrically driven, and will include an electric travelling crane and all modern factory labour-saving devices, &c.



PIRELLI'S WORKS AT SOUTHAMPTON.

**Swiss Enterprise in South America.**—The A.G. Columbus für Elektrische Unternehmungen, which was formed at Zurich some time ago as an investment company, particularly for South America, is reported to have acquired the plant of the electricity company of the province of Buenos Ayres at Bergamino, and the larger portion of the share capital of the Electric Light and Motive Power Co., of Bergamino. It is now proposed to amalgamate the two companies.

**German Lamp Factory in Spain.**—It is stated that negotiations are proceeding with a view to the erection of a German factory for wire lamps in Spain. Those interested in the scheme are the Incandescent Gas Light (Auer) Co., the A.E.G. and the Siemens-Schuckert Works, all three of which work the patents of the United States General Electric Co. for wire lamps in Germany.

**New Zealand.**—A decision has recently been given by the New Zealand Customs authorities that "lightning protectors, switchboards, wall terminal blocks, micro-telephone and telegraph head receivers and breast transmitters" are all to be classified as "electric appliances," under No. 176 of the tariff, the duty being 30 per cent. on foreign manufactures, and 20 per cent. *ad valorem* on British goods.

**Electric Furnaces in France.**—A new company has lately been formed at Levallois, Paris (53, Rue Chaptal), with a capital of £7,000, and the title La Société de Metallurgie Electrique, to acquire from M. Massip, and work, certain patents relating to electric steel furnaces.

**Water Turbines.**—MESSRS. BOVING & CO., LTD., of London, have lately booked the following contracts for hydro-electric plant:—

Two 450-H.P. impulse wheels and governors with the electric generators; Head Works; 1,500 m. of riveted and welded pipes; for the Dorada Railway (Ropeway Extension), Ltd., Columbia.
One 65-H.P. turbine for the town of Waverley, New Zealand.
One turbine of 350 H.P. for the Bressis Tin Mining Co., Tasmania (repeat order).
One turbine of 250 H.P. for Boving & Co., Japan.
One turbine of 250 H.P. against a head of 156 ft., for Messrs. Bagnall and Hilles, Yokohama.

They have also received orders for "Victoria" turbo pumps from firms in Holland, Egypt, India and New Zealand, and from the Harton Coal Co., Pearson & Son, and Easton, Gibb & Co., of Rosyth.

**Patent Application.**—Application for amendment of Patent No. 4,677, of 1906, for "Improvements in or relating to electric arc lamps," has been made by M. André Blondel, of Paris An announcement will be found among our advertisements to-day

**Electric Iron Campaign.**—THE GENERAL ELECTRIC CO., LTD., yesterday opened an advertising campaign in connection with the "Magnet" electric iron, by offering, through the pages of the *Daily Mirror*, one of these irons, complete with connector, flexible cord, and adaptor, for 15 days' free trial, and with a three years' guarantee. It is expected that, being timed a week before Christmas, the campaign will lead large numbers of readers to purchase such irons as Christmas presents. The co-operation of 600 electrical contractors has been secured, these having taken up stocks so as to be prepared for the demand which the free trial offer will create. Nearly 200 electricity undertakings also have interested themselves in the matter, and distributed copies of the above paper to all consumers on their mains.

**Concert.**—The second of this season's series of staff and foremen's smoking concerts given by the EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., was held at the Staff Café, Ponder's End, last Friday evening. Nearly 100 members of the staff and visitors were present. Mr. J. W. Elliott, of the lamp department, was in the chair, supported by vice-chairman J. Davison, engineering stores manager.

**Discounts Notice.**—THE WALSALL ELECTRICAL CO., LTD., of Walsall, have issued a new discount slip in connection with their catalogue, the majority of prices having been considerably reduced. Copies of same will be forwarded on application.

**Holiday and Stocktaking Notices.**—The Midland Electric Manufacturing Co., Ltd., of Birmingham, announce that their works will be closed for holidays and stocktaking from noon on Wednesday, December 24th, until the morning of Thursday, January 1st. A small office staff will deal with urgent communications.

The British Westinghouse Electric and Manufacturing Co., Ltd., of Trafford Park, Manchester, announce that their works will be closed from 5.30 p.m. on Christmas Eve, until 7 a.m. on Monday, December 29th, 1913, also on New Year's Day.

**Fittings Showroom.**—The British Thomson-Houston Co., Ltd., have recently opened a new fittings showroom at Mazda House, 77, Upper Thames Street, London, E.C., wherein are exhibited the varieties of lighting units of which the company have made a speciality, as well as a number of new types. B.T.H. "Eye-Rest" system is of course shown, and indirect fittings of every size and description are hanging from the ceiling. Semi-indirect lighting is represented by a wide range of Alba, Veluria,

B.T.H. Fittings Showroom.

Calla and glass bowl fittings, and direct lighting by Mazdalier, Tungstolier and other fittings equipped with Veluria, Holophane, Pyro, Opalux or Sudan glass reflectors. Some "Fostoria" table standards are shown, made entirely of white or tinted glass, etched in patterns, and moulded into various shapes. These standards have a lamp inside the pedestal as well as under the shade. Table decorations, electric radiators, flat-irons, vacuum cleaners and other manufactures are also in evidence.

**Book Notices.**—"A New Era in Chemistry." By Harry C. Jones. 1913. London: Constable & Co., Ltd. Price 8s. 6d. net.

"*Journal* of the Institution of Electrical Engineers." Vol. LII, No. 114. December 15th, 1913. London: E. & F. N. Spon, Ltd. Price 3s. 6d.

"*Transactions* of the University of Toronto Engineering Society." Vol. VIII, No. 7. November, 1913. Toronto: The Society.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXIX, No. 9. November, 1913. New York: The Society.

"*Transactions* of the Institution of Engineers and Shipbuilders in Scotland." Vol. LVII, No. 2. December, 1913. Glasgow: The Institution.

"*Journal* of the American Society of Mechanical Engineers." December, 1913. New York: The Society. Price 35 cents.

"*Bulletin* Scientifique de l'Association des Elèves des Ecoles Spéciales." Vol. XVI, No. 1. November, 1913. Liége: The University. Price 1 fr.

"*Bulletin* Mensuel de la Société Belge d'Electriciens." Vol. XXX. November, 1913. Brussels: E. Bruylant. Price 1 fr. 75.

"*Bulletin* de la Société Internationale des Electriciens." Vol. III, No. 29. November, 1913. Paris: Gauthier-Villars. Price 2 fr. 50.

"Whitaker's Almanac, 1914." Price 1s. and 2s. 6d. "Whitaker's Peerage, Baronetage, Knightage and Companionage, 1914." Price 5s. London: J. Whitaker & Sons, Ltd.

"Hazell's Annual, 1914." London: Hazell, Watson & Viney, Ltd. Price 3s. 6d. net.

"Village Electrical Installations." By W. T. Wardale. Price 2s. net. "Elementary Graphic Statics." By J. T. Wright. Price 4s. London: Whittaker & Co.

"*Practical Engineer* Electrical Pocket Book and Diary, 1914." London: Technical Publishing Co., Ltd. Price 1s. net.

**Dissolutions and Liquidations.**—J. T. Pickering Hoist and Engineering Co, Ltd.—This company is winding up voluntarily with Mr. S. B. Saunders, of King's Walk, Nottingham, as liquidator. A meeting of creditors is called for December 29th, at 107, Lothair Road, Leicester.

Anderson & Smith, plumbers and electricians, 172, Warbreck Road, Blackpool, and 20, St. David's Road South, St. Anne's-on-Sea. Messrs. M. Anderson and J. G. Smith have dissolved partnership. Debts will be attended to by Mr. Smith.

**Trade Announcements.**—Mr. W. A. Maddick announces that he has severed his connection with Messrs. A. Emanuel & Sons, Ltd., and he will shortly complete arrangements for putting before the trade the electrical specialities and business of Messrs. Maddick & Maddick. His present address is Alfriston Road, Clapham Common, London, S.W.

The Imperial United Lamp Co., Ltd., announces that its telephone Nos. are "Victoria 7274-7275."

Our readers are already familiar with the fact that the Edison and Swan United Electric Light Co., Ltd., are making important changes in connection with their efforts to promptly meet the requirements of the trade for everything electrical. Their new premises at 123/125, Queen Victoria Street, E.C., will have a trade counter entrance at Nos. 228 and 229, Upper Thames Street, where arrangements will be made for a quick counter trade. Large stocks will be held in the building, and in addition the company will provide a rapid motor-van service from the Ponder's End works for bulk deliveries, and a motor-tricar service for small deliveries. The large showroom will be fitted with special consulting rooms for the benefit of the trade and their clients, and it will contain a full selection of artistic fittings and apparatus. In order further to promote rapid communications and deliveries, a private telephone line is being erected between the showroom and the works, and additional public lines are being connected to both of these premises. The foregoing are parts of a scheme to provide a highly organised Ediswan distributing centre.

**Bankruptcy Proceedings.**—W. R. Wedge, electrical engineer, The Arcade, Northampton.—The adjourned public examination of this debtor took place at the County Hall, Northampton, on December 9th, when it was stated that, following the previous hearing, the Official Receiver sent on the necessary books to the Official Receiver at Bolton. Debtor was in Lancashire. On the 5th inst. debtor wrote to Northampton saying that he had been trying to get enough money to enable him to pay his fare to Northampton, but everything had gone against him. He was living from hand-to-mouth, and had not sufficient money to come to Northampton. He asked what was his remedy as he did not want to be guilty of doing anything wrong. He hoped that more time would be allowed him. The Official Receiver stated that he had replied to the debtor that it was clear that he could not pass his examination at present. The Official Receiver added that the debtor was attending at Bolton, and presumably was doing what he could, but a receiving order had been made against him, and he would have to satisfy the Court as to what his responsibilities were. The further hearing was adjourned.

Fredk. Wm. Chamier, mining and electrical engineer, of 59, Fleet Street, E.C.—The public examination was held on December 10th, before Mr. Registrar Hope, at the London Bankruptcy Court. The statement of affairs showed liabilities £639 and assets valued at £18,519. The chief item is a debt of £76,700 due from the Deutsche Beck Bogenlampen Gesellschaft, of Frankfort-on-Main, manufacturers of electric lamps and other apparatus. Under examination by Mr. Walter Boyle, Official Receiver, the debtor stated that he formerly acted as chief engineer of mining properties in Manchuria at a salary of £6,000 per annum and a commission of 10 per cent. on the profits. He resigned that post in 1903, owing to political troubles in Manchuria. In 1906, being possessed of about £60,000 in consols and other securities, he became manager of an electrical company carrying on business at Berlin and Frankfort-on-Main, and received a salary of £1,500 per annum and bonuses. Eventually he acquired a controlling interest in the company and paid away about £73,000 on its behalf. In addition, the company owed him between £3,000 and £4,000 in respect of arrears of salary. It was now in liquidation in the Prussian Courts; witness's claim to £76,000 had been admitted, and he expected to receive £15,000 at the lowest estimate, by way of dividend. Since 1906 he had earned £6,000 by taking out and exploiting patents connected with electrical and mechanical appliances. The examination was concluded.

**Catalogues and Lists.**—Cambridge Scientific Instrument Co., Ltd., Cambridge.—We have received a batch of recently issued lists and leaflets describing some of the firm's manufactures. All are excellently illustrated, and price information is given. No. 120 relates to the "Callendar Recording Pyrometers for Hot-Blast Mains," and describes the application of the firm's platinum resistance pyrometers to temperature measurement, chiefly in connection with hot-air mains and blast furnaces; No. 111 on "Improvements in Hardening and Case Hardening Methods" deals with recent improvements in thermo-electric pyrometry, enabling a high degree of accuracy to be obtained in the measurements; No. 105 describes the "Rosenhain Calorimeter" as now manufactured. It is an improved form of Thomson instrument and provides a simple and accurate method for the determination of calorific value of coal and liquid fuels. No. 118 is the latest list describing the "Duddell Oscillograph" and the various accessory pieces of apparatus necessary for the taking of oscillograms. The latest forms of oscillograph, resistances, cameras, &c., are fully described, and the prices of typical outfits are included in the list, including that for an outfit for use on 50,000 volts. No. 125 ("Lantern Slides of Oscillograms") describes lantern slides, illustrating condenser discharges in single and coupled circuits, reproduced from oscillograms obtained by Dr. J. A. Fleming, F.R.S., and exhibited by him to the Physical Society of London.

The Dart Spring Co., West Bromwich.—Illustrated circulars relating to springs for motors and motor-cars, and steel spring washers.

MESSRS. BAXENDALE & CO., LTD., Miller Street, Manchester.—We have received a copy of an interesting brochure relating to the fiftieth anniversary of the founding of this firm in a small dwelling-house in Manchester, in September, 1863. To-day the firm has works and warehouses in many parts of the kingdom. Pictures of the different premises appear, including lead mills, paint and varnish departments, ironmongery, furniture, silversmiths', electrical apparatus and other showrooms, &c. The number of employés to-day runs into thousands, for as many as 1,200 were present at the jubilee celebration outing to Chester in August last.

MESSRS J. & H. GREVENER, 40, Southwark Street, London, S.E.—New catalogue of 36 pages, containing illustrations and prices of lampholders of different types, keyholders, tumbler switches, counterweights, wall plugs, cut-outs, ball and spider fittings, handlamps, fuseboards, cut-outs, house-service boards, and many other like manufactures.

BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., Trafford Park, Manchester.—Eight-page leaflet (envelope series) relating to their flame and enclosed arc lamps.

MESSRS R. S. PRICE, LTD., Amberley House, Norfolk Street, Strand, London, W.C.—Forty-eight-page descriptive and priced catalogue of the Maihak indicator for gas and oil engines and other service, three-way cocks, reducing mechanism, planimeters, tachometers, and other apparatus. A separate circular describes the Maihak indicator fitted with Böttcher's power counter. Both lists contain full information.

MESSRS. SCHOLEY & CO., LTD., 151, Queen Victoria St., London, E.C.—No. 3 of *Scholey's Magazine* (December) contains some interesting opening comments, a photograph and brief biography of Mr. A. L. C. Fell, an illustrated article on the Frantz electric suction cleaner, more notes on the economy of electric lifts, and particulars of tool steel gears, and the Q V. enclosed indicating fuse.

THE BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, London, E.C.—The *Mazda House News* for December (No. 3), in addition to reminding the reader of a number of Mazda lines suitable for Christmas gifts, contains illustrated articles on the lighting of golf courses, the lighting of printing works, and notes on many other matters of illuminating interest.

ALLGEMEINE ELECTRIZITATS GESELLSCHAFT, Berlin.—Brochure describing a new type of ampere-hour meter adapted for use on small installations, with various improvements; also leaflets relating to a number of machine tools driven by reversible variable-speed motors, and candle-lamps for Christmas-trees.

THE EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., Ponder's End.—A fine catalogue of 150 pages has been prepared (Section VI), in which a large variety of designs of electric light fittings are admirably shown on art paper. Brief particulars of each fitting and prices of same are given in both English and French, the reference numbers and prices being very distinctly printed. Brackets, ceiling fittings, drop pendants, reading, table and piano lamps, table and floor standards, hall and vestibule lanterns, bedroom fittings, suspension fittings and shade lights, appear in numerous styles, and many pages are devoted to a wide range of examples of electroliers. Semi-indirect lighting fittings and switch-covers also have place in the book.

THE WARDLE ENGINEERING CO., LTD., 196, Deansgate, Manchester.—32-page catalogue of lanterns and fittings for street, shop and works lighting. Descriptive matter, well prepared and printed illustrations, and tabulated prices, appear of "Streetlites" patent ventilated cluster lanterns, "Streetlites" sign, shop window and reflector types, also "Beatark," "Inverlite," "Onelite," "Drawlite" and other types, c.i. mill fittings, c.i. oyster fittings, "Acorn" lanterns, brackets and sundry accessories.

**Annual Dinner.**—The annual dinner of the sales department of the WESTERN ELECTRIC CO., LTD., was held at Woolwich on Friday, December 5th, under the chairmanship of the assistant manager, Mr. H. M. Pease. The loyal toast was followed by the "Sales Department," proposed by Mr. A. T. Turney, and responded to by Mr. Pease. The "Branch Office Managers" was proposed by Mr. T. F. Lee, and each manager replied. Mr. A. T. Gillanders proposed "The Chairman," who, in responding, paid a tribute to the loyalty of the sales department staff. A programme of music and song, &c., followed. The function was organised by Messrs. F. K. Jewson, W. E. Page and F. A. G. Pope.

**Meter Approved.**—The B. of T. has approved of single-phase A.C. meter, type LJc, lodged by the ELECTRICAL CO., LTD.

**Calendar.**—THE D.P. BATTERY CO., LTD., Bakewell, Derbyshire.—Once again this company has prepared a charming wall calendar for the new year. The view this time is of Haddon Hall, Bakewell, and it is excellently executed in colour. Small, unobtrusive monthly calendar slips are attached in the right-hand bottom corner.

## LIGHTING and POWER NOTES.

**Argentina.**—The Soc. Anon. de Luz Electrica y Fuerza Motriz de Pergamino has purchased the power house and complete installation in that city of the Compania General de Eléctricidad de la Provincia. The purchase price is $360,000. The new company will increase its capital to one million dollars, which will be invested in the purchase of machinery and electric tramway material.—*Review of the River Plate.*

**Argentina.**—A concession has been granted for the development of the Salta Grande Waterfall for electrical purposes. Two large power stations, each of 75,000 H.P., are proposed, as also that the capital shall be provided by the Governments of Argentina, Brazil and Uruguay.

**Ashton.**—NEW LOANS.—Application is to be made to the L.G.B. for permission to borrow £18,552 for the electricity undertaking.

**Ayr.**—PROV. ORDER.—The T.C. has decided to apply for a prov. order to supply Prestwick with electricity.

**Ballater (Aberdeenshire).**—The School Board has decided to light the village schools and schoolhouses with electricity.

**Belfast.**—PUBLIC LIGHTING.—The experiment of lighting some of the central streets with electric lamps has been so successful that it is understood that the scheme will be considerably extended.

**Bexley.**—PUBLIC LIGHTING.—The General Purposes Committee is considering the question of improving the public lighting, and has requested the Electricity Committee to state what C.P. lamps it is willing to provide for £4 5s. per lamp per annum on the present lighting hours. The present price is £4 5s. per lamp per annum for 117 lamps, and £3 5s. for 227.

**Bleane (Kent).**—WORKHOUSE LIGHTING.—The B. of G. has decided to install electricity for lighting and ironing in the workhouse.

**Chesterfield.**—The T.C. has entered into new agreements for the supply of electricity to Bryan Donkin Co., Ltd., and Robinson & Sons, Ltd., for power purposes, at ·75d. per unit for the first 100,000 units per annum, with reductions to a minimum of ·65d. per unit for 300,000 units or over per annum.

**China.**—We gather from a Hankow paper that a modern electrical installation, including 3,000-volt turbo-generators, motors and lighting, is to be installed at the Hanyang Arsenal. In consequence of trouble experienced with condensers using Yangtse water, an independent cooling plant will be installed. Part of the machinery has arrived, and work was to be commenced immediately.

An electric power plant is to be installed at the salt mining town of Tseleutsing, in Szechuan, at an estimated cost of 40,000 teals. Three-phase 5,000-volt generating sets will be installed to supply H.T. current in the town and neghbouring mining areas. The lighting of the town will be carried out at 220 volts, and machinery is being delivered. The Changsha electrical installation is also to be extended by 300 H.P.

The erecting of transmission poles and lines for the Wuchang electricity works is to be commenced; the station is under construction, and the installation will be completed about the end of next year.

The plant in each of the above cases is being suppled by the Siemens China Electric Engineering Co.

**Continental Notes.**—GERMANY.—A new 3,100-H.P. gas engine and dynamo is being added to the generating plant at the Friede ironworks at Kneuttingen, Lorraine, of the Lothringer Huttenverein Aumetz-Friede.

The first State hydro-electric power station in Bavaria has been completed at Saalach, the equipment consisting of five 2,000-H.P. turbine units. The plant will supply power for the working of the State railways.

NORWAY.—The four Hadeland Municipalities of Gran, Brandbu, Lunner and Jevnaker together propose to raise a loan of about £91,000 for the electricity works which are to be erected at the Toverud Falls.—*Board of Trade Journal.*

SWEDEN.—It is reported that a new company has been formed at Stockholm for the purpose of harnessing some large waterfalls of the River Glaamen, in the province of Nordland, in Norway. The total amount of power to be obtained from these falls has been estimated at 60.000 E.H.P., which is to be used partly for the development of the mining industry in the district, and partly for other industrial purposes. The River Glaamen has its chief sources in the glacier of "Svartisen," which is a great advantage, as the supply of water can never become affected even by the dryest season. The new company is a preliminary promoting company, the capital being £138,900 minimum, which may be increased to £333,300 maximum. But even the larger amount will not be nearly sufficient to carry out the whole scheme.

SWITZERLAND.—The Motor Gesellschaft für Angewandte Elektricität has secured a concession from the authorities of the Swiss Canton of Ticino, to establish a large hydro-electric station, in connection with which 15,000 H.P. will be "exported" to Italy—in other words, transmitted across the frontier for lighting and power purposes.

AUSTRIA.—The municipal authorities of the towns of Gratz and Marburg have jointly formed a company with the title the Gratz-Marburger Drauwerke Gesellschaft, with the object of establishing a large plant to utilise the water power of the River Drau. It is stated that 24,000 H.P. is available, and the energy generated will be used for lighting and power purposes.

**Devonport.**—Proposed New Loans.—The T.C. has decided to apply for sanction to borrow £11,866 for extensions at the electricity works, to be expended as follows:—New offices, £1,237; 1,250-kw. turbo-alternator, with accessories, £7,900; switchgear, £250; cables, £240; steam pipes and traps, £65; superheaters, £420; circulating water pipes and valves, £248; pump house, £428.

**Dover.**—Bulk Supply Proposals.—The borough electrical engineer has reported to the T.C., on the suggestions of the East Kent E.P. Co., Ltd., to supply the Council with electricity in bulk. He states that the general manager of the company informed him that the power station from which the proposed supply would come would be erected at Snowdown Colliery, and it was expected that the works would be ready to supply energy by the end of 1914. There would be two underground cables with a capacity of 1,000 kw. each, and the supply would be three-phase alternating, at 20,000 volts, 50 periods. The company was making arrangements to supply Stoneball Colliery, which was on the way to Dover, and as the question of supplying the Council would affect the size of the cable, it was necessary that the question should receive early consideration. He added that there was no suggestion as to probable terms. The Corporation would have to spend money at the works and buy a good deal of plant if the bulk supply was taken, and have to pay about £5,000; what was to be done outside was another matter, as the current would be of 50 periods, instead of 100, as in Dover. The Council decided to ask the company for its terms.

**Feltham.**—Prov. Order.—The local authority has received notification of an application by a syndicate for a prov. order for electric light.

**Friern Barnet.**—E.L. Proposals.—The U.D.C. understands that the Finchley authority is in a position to supply electricity in the whole of the North and Central Wards; it is now suggested that the Hornsey Council should take over the lighting of the South Ward, and the question has been referred to the Lighting Committee for consideration.

**Galashiels.**—A Committee of the T.C. has approached the Galashiels and District E.S. Co. with reference to an agreement regarding the prices to be charged and the terms upon which the undertaking can be acquired. Mr. George Balfour, one of the directors, said he expected the charge would be 5d. or 6d. per unit for lighting, and from 0·7d. to 2d. per unit for power. The Roxburgh C.C. has notified the T.C. that it will oppose the company's application for a prov. order.

**German S.W. Africa.**—A concession has been granted by the Governor of German South-West Africa to Herr D. K. Hoffmann for the utilisation of the falls on the upper course of the Pangani River. The concessionaire is the owner of large plantations in the district of Pangani, the falls being situated about 31 miles above the locality of this name. Power will be supplied to the factories for the preparation of hemp, where machines are employed for stripping the fibre. The question of the production of nitrogen is also said to be under consideration, together with that of ultimately working the Usambara Railway by electricity.

**Gillingham (Kent).**—The T.C. has been asked as to the supply of electricity at a proposed cement works for a 100-h.p. motor and a 275 h.p. motor. On a five years' contract the Council has decided to offer a supply at ·625d. per unit, with a guaranteed minimum consumption of 250,000 units per annum, subject to fuel clauses. The Council has also offered to supply current to the new works of the Recess Screws, Ltd., at 1d. per unit under a five years' contract, with a guaranteed minimum annual consumption of 50,000 units.

**Gravesend.**—The Electricity Committee has recommended that the charge for current on the flat rate be increased from 4d. to 4½d. per unit from December 24th next.

The engineer has advised the Council to carry out extensions to the works with a view to supplying power and inducing manufacturers to settle in the district. The matter was deferred pending consideration of an application for a power supply.

**Heywood.**—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £3,000 for electricity purposes. This has reference to an application made 18 months ago.

**Highbridge (Somerset).**—Proposed E.L. Scheme.—Mr. J. A. Purves, of Exeter, has taken up with the Council, the question of forming an E.L. Co. for Highbridge. The Council has decided to wait and see how the Burnham scheme answers.

**Holywell.**—Workhouse Lighting.—The B. of G. is obtaining a report on the lighting of the Workhouse premises, the proposals including electric lighting.

**India.**—Nagpur, which is the largest city in the Central Provinces, is now lighted by electricity, which is supplied to the consumers at 220 volts. The distributing current is fed from two main feeding points, and the overhead mains—bare copper wires—cover a distance of 17¼ miles. The contract was carried out by Messrs. Crompton & Co., and three weeks ago the lighting was formally inaugurated by the Commissioner of the Central Provinces.

**Kirkby Stephen.**—The local gas company has decided to proceed immediately with its E.L. scheme, and the Westmorland C.C. has been asked to grant wayleaves for posts for street lighting.

**Knighton.**—E.L. Scheme.—At the recent meeting of the Council, a communication was read from Mr. J. Simon, electrical engineer, London, stating that owing to the difficulty he had experienced in forming the proposed company, he had decided to drop the scheme for supplying the town with electricity at present, but hoped to renew his application later.

**Leeds.**—Strike Troubles.—During the last week the Corporation employés of nearly all grades have been on strike for an advance in wages. So far the electricity supply has been practically unaffected, the drivers, firemen, greasers, labourers, &c., who left work, being replaced by local engineering apprentices and students who offered their services in the emergency. The gas undertaking has been hard hit, and unlighted streets shops and factories have been numerous. For some days only one of the Corporation gasworks has been in use, the others being shut down. The tramway service has been very much curtailed, owing to the absence of drivers and conductors and to the insufficiency of the power supply. At the time of writing the tramway men are returning to work, and it is considered that the strike cannot last much longer.

**London.**—The future of London's electricity supply has, during the past few days, received a good deal of attention in the daily papers, this arising from the proposals of the County of London Co., to which reference was made at a recent meeting of the L.C.C. The *Financial Times*, in summarising the position, remarks that as matters stand at present, the L.C.C. is in a position to expropriate certain electric lighting companies in 1931, and, in these circumstances, the directors of those concerns are not disposed to incur any heavy programme of capital expenditure, for which they are not likely to get adequate compensation when the date of expropriation arrives. This fact has been realised by a very powerful financial group, and, after very careful consideration, it was decided some months ago by these interests to ascertain whether the L.C.C. could be induced to extend the date on which it is at present empowered to take over the companies in question. If something of this sort could be arranged, it might be possible to come to terms with the electric lighting companies for the development of their business on one homogeneous plan.

Apparently the L.C.C. has not officially replied to the proposals, but the matter has been considered by the 13 companies whose interests are affected; any announcement as to definite steps having been taken appears to be premature, in view of the silence of the L.C.C.

The *Daily Telegraph* mentions the financial house of Morgan, Grenfell & Co. as being associated with the proposals. The earliest date at which the L.C.C. can purchase is August 26th, 1931; three years' notice is required, and this must be given to all the companies in the London area, the Council being compelled to purchase all or none. If the L.C.C. decides to purchase the companies—and it has no powers to purchase the undertakings of local authorities—only their value *in situ* would be paid for, and with less than 18 years of life before them, it is considered that the companies would find it almost impossible to raise fresh capital for modernising their plant. It will be remembered that an L.C.C. Special Committee on Electrical Supply is sitting at the moment, with Mr. Merz as its expert adviser, and that an authoritative report on the matter is promised for next year.

An L.C.C. return has just been issued, giving particulars of electricity supply in the metropolitan area for 1911-12. The return covers 16 Borough Councils, 8 Corporations, 18 District Councils, and 33 companies, and shows that the 15 London B.C. undertakings, with 80,600 kw. of plant, supplied 13,405,061 units for street lighting, 37,945,681 units for private lighting, 45,473,198 units for power, and 41,348 units for traction, a total of 96,865,278 units.

The figures for the 14 London companies, in the same order, are: 153.479; 4,097,118; 86,653,358; 61,727,949; and 8,219,070; a total of 160,697,495 units sold.

The municipal figures obviously take no account of the Council's own tramway generating station output, while the traction supply credited to the companies refers to a special case and leaves out of consideration the various railway and tramway power stations owned by companies.

The aggregate revenue of the London municipal concerns was £829,815, averaging out at just over 2d. per unit sold, while in the case of the companies the returns show £1,753,248 and an average of 2·62d.

The capital involved is, roughly, 6½ millions for the municipal and 14½ millions for the private undertakings in London.

L.C.C. Loans.—The Finance Committee has recommended the Council to sanction the borrowing of £9,427 by the Hammersmith B.C., as to buildings, £724; mains, £4,321; sub-station plant, £1,600; services, £1,593; meters, £904, and grab-bucket, £145; also of £29,334 by the Southwark B.C. for the electricity undertaking, as to £900 for site; £1,970 for buildings, and £26,464 for plant, viz., two 1,500-kw. generators, with boilers, condensers and accessories; and of £6,000 by the Stoke Newington B.C. for the electricity undertaking, as to £5,000 for mains and £1,000 for meters.

Southwark.—Application is to be made to the L.C.C. for sanction to borrow £9,512 for the electricity undertaking.

MARYLEBONE.—The Electric Supply Committee has decided (1) in future to undertake no wiring work except small jobs of alteration, &c., on which only contractor's men will be employed; (2) all wiring orders obtained by the department will be passed on to the district contractor; (3) price and quality being equal, the contractors will purchase their materials from the department; (4) trade discount to be allowed to contractors for their accredited customers' showroom purchases; and (5) districts to be re-arranged as may be found convenient. The Committee considers that this arrangement will bring the contractors into closer and more friendly association with the department.

WANDSWORTH.—The B.C. has consented to the proposal of the Electric Supply Co. to suspend electric lamps across High Street, Putney.

WOOLWICH.—BULK SUPPLIES.—The T.C. has applied to the B. of T. for an order to permit it to supply electricity in bulk to the South Metropolitan E.L. and P. Co., and the West Kent Electric Co., Ltd., and to permit each company to give a supply in bulk to the Council.

**Lowestoft.**—PROPOSED LOAN.—The T.C. has decided to apply for a loan of £1,500 for meters, provided the L.G.B. will make the loan repayable in five years.

**Maidenhead.**—STREET LIGHTING.—The T.C. has decided to have Summerleaze Road lighted electrically at a cost of £2 15s. per lamp per annum.

**Malvern.**—The U.D.C. has decided to canvass the West Malvern district with a view to supplying electricity; the estimated cost for extending the cables is £1,500.

**Monmouth.**—The T.C. is to renew low-tension cables, at an estimated cost of £1,500.

**Newcastle (Co. Down)**—PUBLIC LIGHTING.—The U.D.C. has accepted the tender of Messrs. Curran Bros., Belfast, at £185 per annum, for the lighting of the town with electricity.

**Slaithwaite.**—PROV. ORDER.—The U.D.C. has sealed its application for a prov. order. The suggestion that electricity in bulk should be purchased from the Yorkshire Power Supply Co. has been left in abeyance pending the obtaining of the order.

**Southampton.**—ELECTRICITY CHARGES.—At a recent meeting the T.C. discussed two reports bearing on the financial aspect of the electricity undertaking, which were presented by the chairman and engineer of the E.L. department respectively. The former pleaded for an increase in the charges for lighting and heating, by ½d. per unit, on the ground that the business was not sufficiently remunerative, and also because he believed "that the ratepayers having put their hands into their pockets, should get an annual return in the shape of relief of the rates." The chairman's recommendation had been previously rejected by the E.L. Committee.

**Stafford.**—The Corporation has decided that lighting consumers whose yearly accounts amount to £250 net, shall receive 10 per cent. of their consumption at power rates.

**Sunbury (Mssx.).**—PROV. ORDER.—A private application is being made for a prov. order for E.L. over a very extensive area. The Council is objecting to the application unless the compulsory area is extended.

**Taunton.**—PROPOSED LOANS.—Loans amounting to £5,000 for electricity purposes have been applied for by the T.C.

**Teignmouth.**—E.L. SCHEME ABANDONED.—The Council decided last week not to entertain a proposal for a municipal electrical undertaking at a cost of £21,000. The Council already owns the gasworks, the manager of which criticised the proposal adversely.

**Truro.**—E.L. SCHEME.—Arrangements are now in hand for electricity supply in the city, with energy generated at a local mine.

**Wanstead.**—E.L. PROPOSALS.—The U.D.C. proposes to obtain information with respect to E.L. for the district.

**Watford.**—The B. of G. has decided to adopt electricity for driving proposed new laundry plant at the workhouse.

**West Bridgford.**—PROV. ORDER.—The Derbyshire and Notts. E.P. Co. has decided to omit West Bridgford from its proposed prov. order.

**West Ham.**—L.G.B. INQUIRY.—An inquiry was held last week, by Mr. T. C. Ekin, into the application of the T.C. to borrow £21,500 for the purposes of the electricity works, and £3,660 for buildings. It was stated that an output of 37 million units was anticipated this year.

**Wokingham.**—The T.C. has decided to oppose the application of the Reading E.S. Co. for a prov. order to lay cables, &c., through the town for supplying electricity to the York Town and Blackwater Gas Co.

**Whitley Upper.**—The U.D.C. has decided to support the efforts of the Yorkshire E.P. Co. to secure powers for electricity supply in the district.

## TRAMWAY and RAILWAY NOTES.

**Birmingham.**—A singular accident occurred to a tramcar at Soho Hill, Handsworth, on Saturday afternoon. The driver, says the *Birmingham Daily Post*, suddenly applied the emergency brake, and this caused the suspension rod to force its way through the floor of the car, causing injuries to two passengers.

**Bournemouth.**—NEW LOANS.—The T.C. has applied to the B. of T. for loans of £12,000 for 10 new tramcars, and £2,300 for doubling the track in Wimborne Road, Winton.

**Brighton.**—A RAILLESS EXPERIMENT.—The General Purposes Committee proposes to hire a double-deck railless trolley car to run experimentally on London Road.

**Chesterfield.**—NEW TRAMWAYS.—The T.C. has decided to promote a Bill next session for further tramway powers, and to extend the electricity supply area. The estimated cost of the tramways is £12,930.

The T.C. has applied to the L.G.B. for a loan of £3,500 for car-shed extensions and the purchase of three double-deck cars.

**Continental Notes.**—GERMANY.—A memorandum on the present position of the water powers and the electrification of the Bavarian State Railways is about to be published by the Government of that country. Apparently in anticipation of the document, Herr von Seidlein, Minister for Railways, has just delivered a speech which is of a pessimistic character in regard to electric traction in so far as it has been tested in that State. It appears that electrical working with locomotives is already in operation on the lines Garmisch-Partenkirchen-Scharnitz and Garmisch-Griesen, and a mixed system of steam and electric trains will be started in the spring on the line Salzburg-Reichenhell-Berchtesgaden, which will be superseded entirely by electrical working in the course of the summer. So far as experience has been gained, the Minister states that the electrical system has not proved to be quite satisfactory from a technical point of view, as the working has suffered from numerous interruptions in the service, while the economy of the method cannot yet be determined with sufficient certainty. The original scheme was based upon the assumption that the cost of working with electric locomotives would not be greater than with steam locomotives, but this expectation has not been fulfilled. Apart from the higher prices charged for the electric locomotives, the remunerativeness of electrical working, in so far as the power is obtained from hydro-electric works, is closely connected with the question as to how far it is possible to dispose of the surplus power at suitable prices. On this point the Minister remarks that at the Saalach hydro-electric works the Government has many millions of KW.-hours available for which it has hitherto been impossible to find purchasers, notwithstanding many endeavours which have been put forth, and despite the "electricity famine" which has been alleged to prevail in the State. All these considerations, in the opinion of the Minister, render it desirable to await further experience in connection with the lines already converted to electric traction before proceeding with the projected transformation of the railways leading out of Munich. It is considered that the determining factor in regard to further electrification must be that of economy, but it is at present impossible to say when any extensions beyond the existing experimental lines will be undertaken. Nevertheless, it is not intended to abandon the scheme for the utilisation of the Walthen Lake, which has been considered as a means of providing power for other Bavarian railways, although years may elapse before any practical steps are taken in this direction.

The *Norddeutsche Allgemeine Zeitung* denies that any definite plans have been made for the electrification of the Berlin railways. Apparently, so far, the Landtag has only sanctioned expenditure on the preliminary studies in connection with the scheme, and for the trial of several experimental trains.

SPAIN.—A scheme for the construction of an electric tramway between Gibraltar and San Rogues, a distance of about 8 miles, is under consideration.

POLAND.—The Lodz Electric Railway Co. has obtained permission to construct new lines, together with a power station. The total length of the projected lines will be 75 miles, and the cost is estimated at £559,000.—*Board of Trade Journal.*

AUSTRIA.—The Austrian State Railway authorities have for some time been carrying out experiments with electric lighting in the railway carriages. So far about 270 vehicles have been so fitted, and the results have been so satisfactory that a considerable extension of railway carriage electric lighting is about to be taken in hand.

**Ealing.**—The B.C. has decided to engage Mr. Hamilton, general manager of the Leeds tramways, to advise it in the negotiations with the L.U.E. Tramways, Ltd., respecting the postponement of purchase of that undertaking.

**Keighley.**—The Tramways Committee has recommended that a contract be entered into with the Cedes Electric Traction, Ltd., for the supply of, and erection of, overhead equipment on the Oakworth and Eastburn routes, at an inclusive price of £923 per mile, and for the supply of four railless vehicles at £720 each. The length of the route is 6 miles 7 furlongs. The chairman of the Tramways Committee said the system had been in operation on the Ingrow Cross Roads route since May last, and had proved very satisfactory. The single car had run 9,194 miles, and the receipts had been 11·32d. per car-mile. The total cost per mile

was estimated at 7 98d. The Corporation motor-'bus cost 1s. 4d. per car-mile, and the revenue was 12 393d., so that on the 'bus there was a loss of 4d. per mile.

**Leeds.** — The Tramways Committee has decided to extend the railless traction system to East and West Ardsley.

**London.**—A deputation from the Bermondsey B.C. has interviewed the L.C.C. in regard to the reconstruction of the tramways in Southwark Park Road, and submitted a modified scheme which will allow of the conduit system being installed, at a cost for street alterations of only £17,000, as against £67,000 suggested by the L.C.C.

The Council has decided to be represented at the proposed conference with the Executive Council of the Municipal Tramways Association, on the subject of motor-omnibus traffic.

The Finance Committee has recommended the Council to consent to automatic chocolate supply-boxes being fixed, as an experiment, on the upper decks of 37 tramcars; the proposed rental is £2 10s. per car per annum.

The Highways Committee has ordered a report to be prepared on the subject of linking up the tramway system.

**Oxford.**—Recently a local syndicate has placed some motor-'buses on the streets to compete with the horse tramways; these are unlicensed, as, in view of its agreement with regard to the electrification of the tramways, the Highways Committee has, so far, refused to license competing vehicles. The question of obtaining an injunction against the 'bus company is being considered. According to the *Standard*, Messrs. Tilling have applied for a licence to run a fleet of petrol-electric 'buses in the city, and have offered to contribute to the rates in the form of rent, &c.

**Paisley.**—The proposed increase of fares on the long-distance runs of the Paisley and District Tramway Co.'s system was the subject of a long debate at the last meeting of the Renfrew T.C. Bailie Ferguson moved that the Council approach the T.C.'s of Paisley, Barrhead and Johnstone, with a view to jointly supporting a motor-'bus service to run in opposition to the tramways. The Council decided in view of the unsatisfactory nature of the service to communicate with the neighbouring towns served by the company with regard to the increased fares.

**Ramsbottom.**—An endeavour is being made to arrange with Trackless Trolley, Ltd., to send one of its Cedes-Stoll vehicles to Ramsbottom for a period on free trial.

**U.S.A.**—Revised contracts have been made between the Commonwealth Edison Co. and the Chicago railway companies, for the remainder of the concessions of the latter. The railway supply now forms 70 per cent. of the company's huge output. Up to now entirely distinct cable systems and sub-stations have been maintained for the city supply, the surface and the elevated railways. The necessity for this duplication of plant is to be removed under the new arrangement. Under the new contract the maximum demand for any month is calculated from the heaviest hourly morning and evening loads on three consecutive days giving the heaviest six hours' consumption during that month. The Edison Co. has to supply a maximum demand of 20,000 KW., or more if the previous month shows that it is required. The scale of charges varies in the case of the primary charge from $1.25 per KW. for the first 30,000 KW. to $.833 for above 120,000 KW. The secondary charges also vary from ·4 cent per KW.-hour for the first 5 million KW.-hours per month to ·36 cent for above 40 million KW.-hours per month. A coal clause is introduced and the agreement includes many extra provisions for the future.

## TELEGRAPH and TELEPHONE NOTES.

**Post Office Telegraph and Telephone Society of London.**—A meeting took place on Monday to hear an address by Mr. P. W. H. Maycock, a telephone traffic expert, on "Telephone Traffic Statistics."

**The Telephone Service.**—A number of local authorities in the Metropolitan area have been induced to waive the wayleave rentals on telephone poles, on the understanding that the concession will lead to a cheaper and better service.

**Long-distance Telephony.** — Telephonic connection between Berlin and Milan has lately been completed.

**New Cable.**—Owing to the increase of traffic with Germany, it has been decided to lay a new telegraph cable, with four wires, between Emden and Bacten, this being the seventh Anglo-German cable.

**German Colonies.**—The first section of the German wireless telegraph system in the South Seas has been opened to public use, with the inauguration of the stations on the islands of Yap and Nauru. Telegrams to Nauru are dispatched by cable as far as Yap, and are sent on thence by wireless telegraphy.

The wireless station at Kamina, in Togo, German West Africa, has received a number of wireless telegrams from the station at Nauen, a distance of 3,348 miles. The Kamina station will not be able to reply until its new plant has been completed.—*Reuter.*

**Germany.**—The number of automatic telephone connections installed by Messrs. Siemens & Halske, in Germany and abroad, now amounts to over 100,000. Such figures attained in a few years attest the value of the Siemens-Strowger system as regards practical utility. There are 30 private exchanges at work and 12 under construction, and the automatic line-selector is gaining increasing favour for quite small installations.—*Telegraphen und Fernsprech Technik.*

**Austria.**—Automatic telephone exchanges have been set up at Graz and Krakau, and have given most satisfactory results from the points of view of both working and economy. It has, therefore, now been decided to introduce the system into Vienna, with semi-automatic working.

**Communication with Trains.** — Very satisfactory results are being obtained with the installation of wireless telegraphy on one of the express trains of the Lackawanna Railroad, U.S.A., and it is stated that the company will shortly equip all their trains with wireless apparatus.

**Postal Servants.**—On Thursday last week the Postmaster-General informed a deputation from the postal employés that the Government was determined not to grant the 15 per cent. increase of wages asked for. On Tuesday the Joint Executive of British Postal Unions, after considering the matter for 7 hours, decided not to ballot the members with regard to a strike, but to make an appeal to Parliament in the next session.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Ainsworth (near Bury).**—January 5th. Electric lighting at the Sanatorium, for the Bury and District Joint Hospital Board. Specifications 10s. (returnable). F. Wild, Clerk to the Board, Cross Street, Bury.

**Australia.**—SYDNEY (NEW SOUTH WALES).—March 18th.—For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" December 5th.

MELBOURNE.—March 18th. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

BRISBANE. — January 7th. Switchboards, parts and accessories; Telephone instruments, &c.; measuring instruments, &c.; telegraph instruments, &c; protectors, parts, &c. See "Official Notices" December 5th.

**Bedford.**—Corporation. One hand-operated overhead travelling crane. See "Official Notices" to-day.

**Belgium.**—January 19th. The municipal authorities of Antwerp are inviting tenders for the supply and equipment of two transformer stations at the docks in that city and for the supply of a quantity of armoured cable.

**Bradford.**—December 19th. Corporation. One turbo-generator, about 5,000 KW.; storage batteries, boosters and switch and regulating gear; two 1,500-KW. rotary converters, transformers and switchgear. See "Official Notices" November 28th.

January 3rd. Corporation. Supply of electric trolley vehicle equipment. See "Official Notices" December 12th.

**Caistor.**—December 19th. Union Workhouse. E.L. installation, 150 lights. Particulars from Mr. A. A. Padley, Clerk, Union Offices.

**Canada.**—BOWNESS, ALTA.—December 31st. For the Bowness Improvement Co., 200-KW. traction motor, one four-panel switchboard, one 250-K.V.A. generator, and a gas engine. Mr. T. L. Turnbull, 220, 8th Avenue West, Calgary, is the engineer-in-charge.

TORONTO.—January 20th. Board of Control. Mechanical filtration plant, boilers, steam turbo-generator plant, &c. Specifications from Mr. J. Milne, Department of Works, City Hall.—*Canadian Engineer.*

**Carlisle.**—December 31st. Corporation. Two 1,250-KW. high-pressure turbo-alternators; two sets of surface-condensing plant; two 600-KW. rotary converters; and high-tension switchgear. See "Official Notices" December 12th.

**Crete.**—March 13th. Electric tramway concession for 50 years. See this column for December 12th.

**France.**—PARIS.—December 29th. Tenders are invited for the metallic, mechanical and electrical equipment of a movable weir to be built across the Seine at Elbeuf, in replacement of the existing structure. Particulars from M. Vidal, ingenieur en chef des ponts et chaussées, pavillon de la Navigation, Port de la Bourdonnais, Paris.

January 20th. The French State Railway Authorities (Bureaux du Service Electrique, 1re Division), 43, Rue de Rome, Paris, are inviting tenders for the supply and laying of two high-tension three-phase cables between the Denis-Boucher Bridge and the Argenteuil-Friage sub-station, near Paris.

**Leeds.**—December 22nd. Electric light work, children's block, Infirmary, for the B. of G. Thos. Winn & Sons, architects, 84, Albion Street, Leeds

**Leigh (Lancs.).**—December 19th. Corporation. Water-tube boiler, with mechanical stoker, forced draught plant, air heater, &c. See "Official Notices" December 5th.

**London.**—L.C.C.—December 23rd. Steam, exhaust, condenser, feed, &c., piping, water tanks, &c., for Greenwich generating station. See "Official Notices" December 5th.

The Highways Committee recommends that alternative tenders for 50, 100 and 150 new trailer cars, and tenders for 200 electric cars for use in connection with the trailer cars on the Council's southern tramways be invited, also for the supply of tramway fittings equipment, &c., for 1914-15.

The Chief Engineer is to be authorised to obtain carbons for the arc lamps on the Victoria Embankment and Westminster Bridge at a cost of £100.

January 13th. Installation of 130 lighting points at Popham Road Elementary School, South Islington. See "Official Notices" to-day.

G.P.O.—January 5th. Telephone silence cabinets, for the P.M.G. See "Official Notices" November 21st.

Hackney.—Tenders for the erection of electricity sub-stations. Time extended to December 22nd.

**Manchester.**—December 19th. Corporation. Motor-converters or rotary converters and static transformers as follows:—Four 1,000/1,250-kw. sets; one 1,000-kw. set; and two 650/800-kw. sets. See "Official Notices" December 5th.

**Northampton.**—January 12th. Corporation. Double line of tramways to Far Cotton and doubling of section of Kingsthorpe route, also the necessary overhead equipment, underground feeders, telephones, &c. Specifications (£5 deposit) from Mr. A. Fidler, Borough Engineer, Guildhall, on or after 20th inst. Tenders to H. Hankinson, Town Clerk.

**Salford.**—Corporation. 4,000 yards Doulton pattern three-way brown glazed stoneware cable conduits. See "Official Notices" to-day.

**Southampton.**—The tramways general manager has been authorised to renew the rails in a portion of St. Mary Street. Tenders are required for about 100 tons of tram rails to the British standard section No. 4, and for a few lengths of section No. 4c for curves.

**Spain.**—December 22nd. The Spanish Ministry of War in Madrid is inviting tenders for the concession for the supply of electrical energy to the Fabrica de Artilleria Works at Granada, for a period of ten years.

**Swansea.**—January 8th. Corporation. One or two years' supply of motors and starting switches. See "Official Notices" to-day.

**Turkey.**—Constantinople.—Tenders are required (1) for the erection of four wireless stations; (2) Supply of 12 501-metre rolls of submarine telegraph cable, with 18 conductors, and paper insulated. Ministry of Posts and Telegraphs, Constantinople.

**Wigan.**—December 22nd. Corporation. Six double-deck tramcar bodies with top covers, six trucks, six complete electrical equipments. See "Official Notices" December 12th.

**York.**—December 22nd. Corporation. Stores for electricity and tramways department. See "Official Notices" December 5th.

## CLOSED.

**Aberdeen Line.**—A contract for "Wotan" and tantalum drawn-wire lamps and carbon-filament lamps for the Aberdeen Line for the ensuing 12 months has been received by Siemens Bros. Dynamo Works, Ltd., from Messrs. G. Thompson & Co., Ltd.

**Accrington.**—The municipal authorities of Accrington have just placed an order with Leyland Motors, Ltd., Leyland, for a petrol motor-tower wagon for use in connection with the maintenance of the electric tramway overhead conductors.

**Ashton-under-Lyne.**—The Electricity Committee has accepted the tenders of Mr. H. Johnson and the New Moss Colliery Co., for coal during six months.

**Australia.**—According to the *Australian Mining Standard* the following tenders have been accepted by the Postmaster-General's Department:—

Commonwealth.—
1,768 800 B type insulators, £20,003.—Commonwealth Art Pottery and Insulator Co.
426,000 A type insulators, £12,282.—Fire Brick, Insulator and Pottery Co. of Victoria.
518,000 A type insulators, £12,509.—Imported through Dalgety & Co., Ltd.
78,000 A type insulators, £1,969.—Imported through Webster & Co.

Victoria.—
333 tons sulphate of copper, not to exceed £9,324.—Mond Nickel Co.
15 magneto non-multiple switchboards, 50 lines, £29 each; 35 magneto cordless switchboards, 10 lines, £12 each.—Western Electric Co., Ltd.

N.S.W.—
5,000 single-pole strips and protectors, with carbon plate arrester, £1 7s. 6d. each.—Western Electric Co., Ltd.

Queensland.—
Cast-iron pot-heads.—Siemens Bros. Dynamo Works, Ltd., and Noyes Bros. (Sydney), Ltd.
2,000 glass cells, for Callaud battery, 2s. 8½d. each; 1,000 glass cells, 7d. each.—Brisbane Electrical Co.
6,000 glass cells, 4s. per doz.—British G.E. Co., Ltd.

South Australia.—
Telegraph and telephone material.—India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
40,000 copper tapes, £1 0s. 3d. per 1,000; 5 tons bronze wire, 70 lb. per mile, £95 per mile.—B.I. and Helsby Cables, Ltd.
30¾ tons hand-drawn copper wire, £83 4s. per ton.—R. Johnson, Clapham and Morris, Ltd.
2,800 zincs for gravity cells, Star pattern, 1s. 5d. each.—A. W. Dobbie & Co.

Western Australia.—Lightning arresters and detectors.
30 miles tinned copper, rubber-insulated wire, No. 20, L.S.W.G., £3 13s. per mile; 5 miles ditto, No. 22, L.S.W.G., £2 17s. 6d. per mile.—B.I. and Helsby Cables, Ltd.
100 detectors, aluminium cases, £3 5s. each; 450 miles twisted pair, tinned annealed copper wire, rubber-insulated, taped and braided, £14 4s. per mile; 70 miles tinned copper wire, rubber-insulated and braided, £5 7s. per mile; 100 miles twisted pair, outside distributing wire, £17 15s. per mile.—General Electric Engineering Co.
Telegraph material.—India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
Telephone material.—J. Bartram & Son, Pty., Ltd.
Telephone material.—Siemens Bros. Dynamo Works, Ltd.
Telephone material.—Western Electric Co. (Aus.), Ltd.
Condensers, insulators and tinned copper wire.—J. C. Fuller & Son.
150 cable distributing boxes, 5 pairs, 8s. 3d. each; 250 ditto, 13 pairs, 14s. each; 200 ditto, 26 pairs, £1 2s. 6d. each; 50 ditto, 39 pairs, £1 10s. each; 150 ditto, 52 pairs, £2 each.—W. T. Henley's Telegraph Works Co., Ltd.
15,000 zincs, for gravity cells, Star pattern, 1s. 2¾d. each.—H. Armstrong, Ltd.
Various telephone material and 100 miles twisted pair wire, £19 per mile.—Malloch Bros.
Forty miles tinned-copper wire, vulcanised rubber-insulated wire, No. 18 L.S.W.G., £8 10s. per mile.—Noyes Bros. (Melbourne) Proprietary, Ltd.
Enamelled wire.—Imperial Electric and Engineering Co.
Ninety-two tons hard-drawn copper wire, £84 per ton.—Gibbs, Bright and Co.
Five thousand glazed earthenware four-duct conduits, 4s. 4d. each; 1,800 ditto six-duct, 6s. 2d. each.—Mills & Co.
Automatic switchboard, for Perth, £42,612.—Automatic Telephones (Australia), Ltd.
Thirty thousand insulators.—Theodore Zwicker & Co.

Sydney.—Municipal Council:—
Metal-filament lamps, £987.—Australian Metal Co.
Arc lamp winches (£170).—Warburton, Franki, Ltd.
Three thousand one hundred fuse-box replacements, £87 10s.—B.I. and Helsby Cables, Ltd.
One hundred thousand A.C. flame arc lamp carbons, £1,094.—Siemens Bros. Dynamo Works, Ltd.

Melbourne.—City Council:—
Electric meters, £767.—Chamberlain & Hookham, Ltd.; ditto, £817.—Reason Manufacturing Co.; ditto, £498.—A.E.G. Co.
Three-phase transformers, £432.—Johnson & Phillips, Ltd.—*Australian Mining Standard.*

Melbourne Railways.—The *Australian Mining Standard* states that, acting on the advice of Mr. C. H. Merz, the Victorian Railways Commissioners have accepted the tender of Siemens Brothers Dynamo Works, Ltd., for supplying the switchgear and accessories for the electric power station in connection with the suburban electrification scheme, the amount being £140,000. The whole plant will be manufactured in Great Britain. For the manufacture of the large condensing plant required, the tenders submitted by the G. Weymouth Proprietary, Ltd., of Richmond (V.), have been accepted, the total amount being £85,251. The Railways Commissioners express their satisfaction that a local firm should have secured this important contract in competition with overseas tenderers.

**Barnes.**—The District Council has accepted the tender of Pooley & Austin, at £141, for the supply of a 10-kw. steam dynamo, with Reavell engine and Mawdsley generator, with switchboard complete.

**Bournemouth.**—The T.C. has accepted the following tenders for the supply of 10 new tramcars:—
United Electric Car Co., Ltd.—Car bodies, £499 each, and one vestibule, £26.
Brush Electrical Engineering Co., Ltd.—Brill type trucks, £130 each.
British Westinghouse Co., Ltd.—Electrical equipment, £343 per car, ditto for brakes, £150.

**Bradford.**—The Electricity Committee has accepted the tender of Messrs. Brown Manufacturing Co., Ltd., for the supply of uniform clothing, as follows:—30 jackets at £1 8s. 11d. each, 30 waistcoats at 7s 9d. each, 60 pairs of trousers at 15s. 9d. per pair, and 30 caps at 2s. 11d. each.

**Chesterfield.**—In connection with the tramways, the T.C. has accepted the following tenders for three double-deck cars:—
Brush Electrical Engineering Co., Ltd.—Car bodies, £469 each.
British Westinghouse Co., Ltd.—Electrical equipment, £282 per car, electrical track brakes, £55 per brake.

The Council has also accepted the offer of Messrs. Griffiths and Millington of £300 a year for the right of fixing advertisements on 17 cars for a term of seven years.

**Clacton-on-Sea.**—The U.D.C. has accepted the tender of Messrs. Ward, of Silvertown, for an oil fuel tank of 35 tons capacity, for the new Diesel plant, at £65.

**Dover.**—The T.C. received the following tenders for installing the electric light at Barton Road schools:—

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| Mr. Martin, Dover (accepted) | £51 |
| J. Wright & Son | 85 |
| Mr. Robson | 66 |
| Mr. Pink | 63 |

**Glasgow and Leith.**—The Glasgow Corporation has ordered two petrol motor tower wagons from Halley's Industrial Motors, Ltd., Yoker, for use in connection with the maintenance of the tramway overhead conductors. The Borough of Leith has also placed an order with the same company for a second 25-h.p. tower wagon.

**L.C.C.**—The Education Committee recommends the acceptance of the tenders of G. F. Ratcliffe & Co., of £365 10s 6d., and R. H & J. Pearson, Ltd., of £367, for installing electric light in the Hammersmith Trade School for Girls, and the Lancaster Road, Kensington, L.C.C. School respectively.

Tenders for electric lighting at the following schools are expected to be received either before the adjournment of the Council for, or during, the Christmas recess. The Committee recommends that the chairman, deputy chairman of the Council, with the chairman and vice chairman of the Education Committee, and of the Building Sub-Committee of the Education Committee, be authorised during the recess to open and accept the lowest satisfactory tender in each case:—Vernon Square, Finsbury; Popham Road, Islington; Ranelagh Road, Westminster; Ocean Street, Stepney.

The Stores and Contracts Committee recommends the acceptance of the tender of the Edison & Swan United Electric Light Co., Ltd., for electric lamps, Schedule No. 17 items 8 to 27 (metal-filament lamps, drawn wire (British), for 12 months, and that the Committee be authorised to accept the lowest satisfactory tenders during the Christmas recess, for Schedules 14 (electric fittings), and 15 (electric insulating materials).

The Fire Brigade Committee reports that electric charging apparatus has been installed at Old Kent Road Fire Station at a cost of £52, and recommends that Messrs. Dennis Bros. be allowed to sub-let to Messrs. Crompton & Co., the necessary electrical work in connection with motor fire appliance for smoke helmet work.

The Highways Committee is to obtain 1,500 machines for cancelling return and transfer tickets, at a cost of £900. The tender of Messrs. J. Stirk & Sons, Ltd., at £1,020, is to be accepted for the supply of a machine for cutting high check rails on tramway tracks.

The undermentioned tenders have been received for the supply of 2½ tons of T.C.C. copper wire '229 in. diameter and 7½ tons of D.C.C. copper wire '229 in. square.

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| R. R. Todd, High Holborn, W.C. (agent for Felten and Guilleaume, of Mulheim-on-Rhine, Germany) .. (accepted) | £833 |
| London Electric Wire Co., and Smiths, Ltd. .. .. .. .. | 853 |
| B.I. and Helsby Cables Ltd. .. .. .. .. .. .. | 866 |
| Manchester Armature Repair Co., Ltd. .. .. .. .. | 897 |
| Callender's Cable and Cons. Co., Ltd... .. .. .. .. | 950 |
| Western Elec. Co., Ltd. .. .. .. .. .. .. | 956 |
| I.R., G.P. and Telegraph Works, Ltd... .. .. .. .. | 987 |
| W. T. Henley's Teleg. Works Co., Ltd. .. .. .. .. | 1,024 |

The Committee report the acceptance of the offer of Messrs. Newton Bros. of £320 for the supply of coils in connection with the reconstruction and rewinding of motor-generators, and that of Messrs. J. G. Ingram, Son, Hackney Wick, at £206, for the repair of plough bases. Three Burroughes adding machines are to be purchased, at £460, for use in the tramway department.

HAMMERSMITH.—The Electricity Committee has accepted the tender of Messrs. Siemens Bros. for the supply of 50 white light arc lamps, for hiring out, at £5 15s. each; and of the General Electric Co., Ltd., for arc lamps, to be supplied singly or as required, at £9 10s. each.

For the supply of mechanical stoker coal for 12 months, the tender of Messrs. Cory Bros. & Co. of 11s. 11d. per ton was accepted.

The tender of Messrs. Toy & Winslow has been accepted by the Metropolitan Asylums Board for installing electric light, telephones, &c., at the Board's research laboratory.

SOUTHWARK.—The B.C. is purchasing a 23-H.P. motor from the Electrical Co., Ltd., at a cost of £56 11s.

**Newcastle (Co. Down).**—The Urban Council, on 10th inst., accepted the tender of Messrs. Curran, Belfast, for the lighting of the town by electricity.

**New Zealand.**—Tender Board. 3,000 B.B. wall telephones, £7,537—B. L. Donne.—*Australian Mining Standard.*

**Norwich.**—The Corporation Electricity Committee has accepted the tender of Messrs. C. A. Parsons & Co., Ltd., for a 3,000-KW. turbo-alternator, complete with condensing plant, and with two 1,200-KW. rotary converters by Siemens Bros. Dynamo Works, Ltd., at £8,578.

**Nuneaton.**—The T.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., for 300 yards of 15 three-core cable for extensions, at £108.

**Pontefract.**—The B. of G. has accepted the following tenders:—

E. Brook, Ltd.—Motors, &c., £72.
Simplex Conduits, Ltd.—Lamps, £47.

**Salford.**—The E.C. has accepted the tender of Messrs. A. J. Kirby & Co. for a complete covering with pitch-pine boards for the water-softening plant, for £95.

**Sunderland.**—The T.C. has accepted the following tenders:—

B.I. & Helsby Cables Co.—Cables.
I.R., G.P. and T. Works Co.—Cables.
Siemens Bros.—Meters.
A. Wright & Co.—Calorimeter.
Hopkinson & Sons, Ltd.—Wrought steel saddle pieces.
Dewrance & Co.—High-pressure steam valves.

**Walsall.**—A contract for traction type tantalum lamps for the borough tramways has been placed with Messrs. Siemens Bros. Dynamo Works, Ltd.

## FORTHCOMING EVENTS.

**Institution of Electrical Engineers (Birmingham Local Section).**—Friday, December 19th. At 7.30 p.m. At the Grand Hotel. Annual Dinner.

**Institution of Mechanical Engineers.**—Friday, December 19th. At 8 p.m. At Storey's Gate, S.W. General Meeting.

**North-East Coast Institution of Engineers and Shipbuilders.**—Friday, December 19th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General meeting.

**Institution of Civil Engineers (Students).**—Friday, December 19th. At 8 p.m. At Great George Street, S.W. Paper on "Air-Filtration and the Cooking and Ventilating of Electrical Machines," by Mr. W. E. Gurry.

Tuesday, December 23rd. At 8 p.m. At Great George Street, S.W. Further discussion of paper on "Cyclical Changes of Temperature in a Gas-Engine Cylinder," by Prof. E. G. Coker and Mr. W. A. Scoble.

**Manchester Electro-Harmonic Society.**—Friday, December 19th. At 7.30 p.m. At Albion Hotel. Third Concert.

**Junior Institution of Engineers.**—Friday, December 19th. At 8 p.m. At 39, Victoria Street. Paper on "Continuous Feeding Elevators," by Mr. T. C. Morewood.

Saturday, December 20th. At 2.30 p.m. Visit, Generating Station of the Charing Cross & Strand Co. at Stratford.

**Association of Mining Electrical Engineers.**—Saturday, December 20th. At 4.30 p.m. At Royal Technical College, Glasgow. Paper on "Electric Winding," by Mr. J. Gillespie.

**Institute of Marine Engineers.**—Monday, December 22nd. At 8 p.m. Discussion on Fuel Test.

**Salford Technical and Engineering Association.**—Friday, December 26th. At 6.15 p.m. At the Institute. Annual Social.

**Royal Institution of Great Britain.**—Saturday, December 27th. At 3 p.m. At Albemarle Street, W. Juvenile lecture, first of a series on "A Voyage in Space," by Prof. H. H. Turner.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the next two weeks:—

Monday, December 22nd to Saturday, December 27th.—Headquarters will be closed for technical instruction, but will be open for the transaction of regimental business.

Monday, January 5th.—"A" Company. Technical instruction, 7 p.m. to 10 p.m.

Tuesday, January 6th.—"B" Company. Ditto.

Wednesday, January 7th.—Recruits only. Infantry drill and technical instruction, 7 p.m. to 10 p.m.

Thursday, January 8th.—"C" Company. Technical instruction, 7 p.m. to 10 p.m.

Friday, January 9th.—"D" Company. Technical instruction, 7.30 to 9.30 p.m. Special class on Crossley engine, 7 to 8 p.m.

Saturday, January 10th.—Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

## NOTES.

**The Christmas Holidays.**—We shall be glad if readers and advertisers will take special note of the following arrangements consequent upon the ELECTRICAL REVIEW for December 26th having to appear on the morning of Wednesday, December 24th.

It will be necessary for that issue to go to press much earlier than usual, and it is imperative that all communications for the editorial department, except the latest items of special news should be sent in so that we receive them by Monday morning next, December 22nd.

The advertisement department announces that all new advertisement copy and alterations to existing displayed advertisements should reach 4, Ludgate Hill, E.C., not later than this morning, December 19th. "Official Notices" and small prepaid advertisements can be received up to 9.30 a.m. on Tuesday, 23rd inst.

**The B.T.H. Operatic Society.**—How Art may be allied with Science is well exemplified by the programme of the B.T.H. Operatic Society, which this week is producing "The Mikado," at the Rugby Hippodrome, and has issued a dainty souvenir of the performance. This is the third production of this highly talented amateur company, the members of which are all members, or the wives of members, of the B.T.H. staff or works. The orchestra is also recruited from the B.T.H. company, the whole of the performers, therefore, being amateurs; but if the production of "Pinafore" last year by practically the same artistes affords a true criterion, their rendering of the "Mikado" will compare favourably even with the work of professional companies. We trust that their success will again be as complete as they could wish.

**Appointments Vacant.**—Shift engineer for Buxton U.D.C. (30s.); distributing superintendent for Sunderland Corporation (£182). Cable jointer, for Salford Corporation. Particulars are given in our advertisement pages.

**Inquiries.**—Makers of a mechanical joint suitable for concentric lead-covered and armoured cable, having outer lead and armour earthed, are asked for.

**Australian Labour Conditions.**—Once more we are tempted to refer to the conditions prevalent in the Australian electrical business. Mr. Newbery, the chairman of the Iron and Shipbuilding Trades Group of New South Wales, has varied his previous award dealing with electrical workers. It is now arranged that a week's work is to consist of 48 hours, made up of 8¾ hours Monday to Friday, between the hours of 7.30 a.m. and 5.30 p.m., and 4¼ hours on Saturday between the hours of 7.30 a.m. and 12.15 p.m. Double time is to be paid for all Sunday or public holiday work unless otherwise specified. Foremen are to be paid 3s. per day more than electrical mechanics, but are not to be paid for overtime. Leading hands are to get 1s. 6d. per day over the ordinary rate. No improvers are to be allowed to enter the business, and those already serving in that capacity are to qualify as journeymen as soon as possible. Future entry into the business is to be through a period of apprenticeship. An interesting feature of the new regulations is that wherever the conditions are unfavourable to health or injurious to clothing, dirt money at the rate of 1d. per hour is to be paid to all men engaged in fitting, installing, repairing or overhauling electrical apparatus between ceilings and roofs or under floors. We think that if in this country a claim of 4s. per week were admissible for clothes becoming dirty, it would be asked for by the great majority of the men engaged in electrical engineering work.

**National Illumination Committee of Great Britain.**—A provisional Committee, formed of representatives of the Illuminating Engineering Society, the Institution of Electrical Engineers, the Institution of Gas Engineers, and the National Physical Laboratory, held a meeting on November 29th last, at which arrangements were made for the formation of a National Illumination Committee to be constituted according to the Statutes of the International Illumination Commission, with the primary object of affiliating Great Britain to that Commission. The provisional Committee recommended that the National Committee should consist of five representatives of each of the three technical Societies, and two representatives of the National Physical Laboratory. This recommendation has been adopted, and the following have been nominated as members of the Committee :—By the Illuminating Engineering Society: Mr. Leon Gaster, Mr. F. W. Goodenough, Prof. Silvanus P. Thompson, and Mr. A. P. Trotter (this Society has not yet nominated its fifth representative); by the Institution of Electrical Engineers: Mr. F. Bailey, Mr. W. Duddell, Mr. K. Edgcumbe, Mr. Haydn Harrison and Prof. J. T. Morris; by the Institution of Gas Engineers: Mr. E. Allen, Mr. J. Bond, Mr. W. J. A. Butterfield, Dr. H. G. Colman and Mr. H. Watson; and by the National Physical Laboratory: Dr. R. T. Glazebrook, C.B., and Mr. C. C. Paterson. The first meeting of this National Committee took place on the 2nd inst., when the following were chosen as officers :—Chairman: Mr. E. Allen, of Liverpool; Vice-chairmen: Mr. W. Duddell and Mr. A. P. Trotter, both of London; and Honorary Secretary and Treasurer: Mr. W. J. A. Butterfield, of London. Great Britain is entitled to two delegates on the Executive Committee of the International Illumination Commission, and Dr. H. G. Colman and Mr. W. Duddell were accordingly appointed by the Committee as the delegates from this country.

**Electricity Supply Rifle League.**—Representatives from the clubs composing this league recently met a representative team from the London and South-Western Railway Rifle Club, on the range of the Central Electric Rifle Club at St. John's Wood. The occasion was the return fixture between the two teams, whose first meeting took place at Clapham Junction in the early part of this year, when the railwaymen won a most exciting match by one point. The conditions were the same as in the initial encounter, viz., 10 shots at the S.M.R.C. match target at 25 yards (five bull); 12 men to shoot and 10 highest scores to count in the match. The result was :—Electricians, 965; Railwaymen, 938. At the conclusion of the match, which had been witnessed by Sir Alexander Kennedy, F.R.S. (President of the League), Mr. C. Newton Russell (a Vice-President of the League, and borough electrical engineer for Shoreditch) and Mr. Buckmaster (of the London and South-Western Railway) the company adjourned to the Eyre Arms for a knife-and-fork tea, with Sir Alexander Kennedy in the chair. It is hoped that a further match will be arranged in order to decide as to which is the better team.

**Losses in Transmission Towers.**—An article in the *Electrical World* describes experiments made to ascertain the hysteresis and eddy-current losses in steel towers, to be used for a 240-mile transmission at 150,000 volts, 50 cycles. The middle wire of the three-phase line passes through the centre of the steel framework. It was found that with 200 amperes the loss per tower was 28·8 watts at 60 cycles, and 18·0 watts at 25 cycles; with 100 amperes the losses were 5·9 and 1·8 watts respectively. The losses are insignificant compared with the power transmitted.

**Boiling Carbon.**—At a meeting of the Scientific Society of Breslau last week, Prof. Lummer, Director of the Physical Institute, gave a demonstration in which he brought carbon to the boiling point. He had previously made the discovery that carbon could be liquefied by manipulation of the current in an electric arc lamp, the carbon rods of which began to boil at a certain pressure. The product thus obtained proved to be graphite.—*Financial Times.*

**Prosecution.**—At Ton-Pentre Police Court, on December 8th, Arthur Hopkins, electrical engineer, was fined 40s. for having a cigarette in his possession at the Britannic Colliery, Gilfach.

**Electric Steel.**—It is stated that the United Burbach-Eich-Dudelingen Iron and Steel Works Co., of Luxemburg, which erected at its Eich works open-hearth furnaces in connection with the electrical production of steel some time ago, has now succeeded in transforming the early unfavourable results into satisfactory results, so that the plant is not affected by the downward tendency in the iron and steel trades. Apparently encouraged by the experience gained, the Gelsenkirchen Mining Co. now also proposes to erect open-hearth furnaces to the number of about 12, for the purpose of producing steel by electricity, the furnaces to be located at Esch, on the Alzette, and at other works belonging to the company. The specialities made from electrical steel, such as machine parts, curved rails, &c., enjoy an active demand, and are consequently less subject to the price fluctuations in the steel market.

**Electric Vehicle Trial.**—One of the Arrol-Johnston-Edison electric coupés, similar to the vehicle which made the run from Dumfries to London during the past summer, has just been submitted to a trial on Brooklands track, under the observation of the Royal Automobile Club, with the view of testing the distance that could be run on one charge of the Edison battery. The weight of the car was, approximately, 27¼ cwt. and, with passengers, about 30½ cwt. The car ran a distance of 54·85 miles without stopping, and at an average and even speed of 15·99 miles per hour.

**Insulators made in Australia.**—The *British Australasian* has the following paragraph regarding the recently placed orders for insulators :—"For several years Australian manufacturers of telephone insulators have endeavoured to obtain a share of the Postal Department's business, but they have been unable to compete with foreign firms on the question of price. However, in a recent calling for tenders for a further supply of insulators, so little difference was found in the quotations submitted by the Commonwealth Art Pottery and Insulator Co. and outside firms, that Mr. Wynne had no hesitation in patronising the local industry. The present order comprises 250,000 of the B type of insulator, 10,000 of the A type, and about 30,000 tubes, at a cost of about £3,000. The B type insulators have passed exhaustive Governmental tests, and the order for 10,000 of the A type is in the nature of an experiment."

**The Electro-Harmonic Society (London).**—A very successful Smoking concert was held on Friday last; the King's Hall was crowded, as usual, and the audience manifested cordial appreciation of the programme, which was both varied and enjoyable.

**Institution and Lecture Notes.**—Institution of Electrical Engineers.—The tenth annual dinner of the Students' Section was held on Monday, December 8th, at the Trocadero Restaurant, about 40 Students being present.

In proposing the toast of the President and the Institution, Mr. R. E. Dickinson (Vice-Chairman Students' Section), who occupied the chair, spoke of the higher aims and dignity of the Institution, and thanked those Members of Council who, by attending Students' meetings, rendered such valuable assistance. He expressed the pleasure of the Students that one who had risen from their ranks should again be elected President of the Institution. The President (Mr. W. Duddell), in replying, said that every Student "had a baton in his knapsack," and he trusted that many of those present would reach the presidential chair. For the past 10 years, he had read every Student's paper, and, except in expression and arrangement, many of these were as excellent as the Members' papers. The object of the Students' Section was to afford practice in writing and discussion. As regarded the A.M.I.E.E. examination, most of the students were, or had been, in attendance at colleges, and college diplomas or university degrees would exempt them from the Associate Membership examination. Those who were not exempted need not fear the ordeal; the examination would be framed simply to determine the technical efficiency of candidates, and the Council were prepared to consider these in lieu of set examination papers.

The toast of the Students' Section was proposed by Mr. A. H. Seabrook (Member of Council) who commented regretfully on the rapid flight of time which so quickly made students into members of council, and members of council into "old fossils." The rising generation of electrical engineers should not neglect the commercial and financial aspects of their profession, but should pay close attention to the applications of electricity to every-day life. With regard to these, electricity was indeed still in its infancy. Lighting and power applications were well established, but a vast field, yet hardly touched in this country, included the application of electricity to automobiles, heating and cooking, metallurgy and chemical work. A matter which had been referred to this year by every Local Section chairman was the importance of gasifying coal before combustion, so that the valuable by-products might be conserved.

Mr. S. M. Hills (chairman, Students' Section), in replying, said that, in view of the many counter attractions in the metropolis, the progress of the Students' Section must be regarded as satisfactory. Engineering societies in the colleges retarded somewhat the growth of membership and activity of the Students' Section. There was a difficulty in obtaining students' papers in London. If a good paper were taken as an exemption from the A.M.I.E.E. examination, the problem would, he thought, be solved.

"The Colleges" was proposed by Mr. E. L. M. Emtage, who emphasised the necessity for co-operation to improve the status of electrical engineers. Isolated associations should not be necessary if all students rallied round the Institution. The colleges could

do much to improve matters by encouraging their students to participate in the social life of the colleges and more particularly in the wider activities of the Institution. Replying to this toast, Dr. S. P. Thompson (past president) stated that the industrial depression which had been reflected in the colleges a few years ago had passed and the colleges were now "healthy." In establishing the Associate Membership examinations, the Institution had followed the lead of the Civil and Mechanical Engineers, and it was a noteworthy fact that in the heterogeneous committee appointed by the Council to frame the examination regulations, the collegiate members were the most anxious that the examinations should not be academic. Examinations would be as simple, direct and practical as possible, and Mr. Hills's suggestion was already in effect adopted, for theses presented by candidates might be students' papers—possibly improved by aid of the discussion.

In proposing "The Guests," Mr. E. B. Driver (Hon. Sec. S. S.) welcomed the representatives from the sister institutions and looked forward to joint technical as well as social meetings. Civil, mechanical and electrical engineering were now so interdependent that such meetings could not fail to be beneficial. Mr. W. M. Mordey (past president), in replying, emphasised the debt of gratitude owed by students to Dr. Thompson for his technical teaching, and urged students to take vigorous practical interest and part in the work of the Section. He said the successful electrical engineer must now be a competent general engineer, with a special knowledge of electrical matters. An electrical engineer was more likely to make a mistake through not knowing how to mix concrete, than by not being able to design the winding of a transformer. Replying on behalf of the Students' Section I.C.E., Mr. P. G. Bowie (chairman) agreed that the root of most of the troubles of Students' Sections lay in insufficient social intercourse. Joint meetings would undoubtedly be most valuable.

An excellent musical programme was provided, and the work of the hon. secretary and the Dinner Committee was recognised by an enthusiastic toast.

The twelfth annual dinner of the SCOTTISH SECTION of the I.E.E. was held in the Grosvenor Restaurant, Glasgow, on December 11th, Mr. J. A. Robertson, of Greenock, presiding. Mr. A. B. Anderson, member of the Council of the I.E.E., in the absence of the Very Rev. Provost Deane, St. Mary's Cathedral, proposed the "Imperial Forces." Commander Aklom and Sir George Beatson responded; the former, speaking for the Navy, said that about a month ago he was examining a modern battleship, and he was told that it had 378 motors for doing the work of the ship. The Navy had always been keen on electricity; 25 years ago a battleship cost half a million; the battleship of to-day cost 2½ millions, and the difference thus represented was largely due to the development of electrical science. Sir John Ure Primrose, Bart., proposed "The Houses of Parliament," Lord Rosebery replying for the Upper Chamber, and Mr. D T. Holmes, M.P., for the House of Commons. Dr. Ferranti submitted the "Corporation of Glasgow," pointing out that the city of Glasgow was of special interest to them in respect of its electrical activities. The electrical undertaking of the Corporation had this year reached its majority, and when they considered how successfully it had been carried on during the 21 years of its existence, they must wish to congratulate the Corporation in general, and their engineer, Mr. Lackie, in particular. Lord Provost Stevenson, who replied, recalled that three months ago he had been in America, and found that supply companies there were distributing carbon-filament lamps free of charge among their consumers. The reason of this was that the metal-filament lamp took only one-third of the energy taken by the carbon-filament lamp, and the companies induced their consumers to continue using carbon-filament lamps with a view to keeping up their revenue from the sale of electrical energy for lighting purposes. The T.C. were now supplying power at ¾d. and light at 3d. per unit; that seemed to indicate that in the immediate future electricity would enter to an increasing extent into all the affairs of their daily life, and enable them get rid of the smoke problem. At this stage the Chairman said that most of them would be aware that, after six years' service, their honorary secretary (Mr. Sayers) had felt himself compelled to give up that position to enable him to devote more of his time to his private business. All of those who had come into contact with Mr. Sayers knew of his courtesy, but they did not know of the untiring energy and hard work that Mr. Sayers had devoted to his office as their secretary. They felt they could not let the occasion go past without signifying in some tangible way their appreciation of Mr. Sayers's work. Mr. Sayers was not leaving them altogether. They were to retain him on the Section Committee, where they would get the benefit of his experience and advice. He asked Mr. Sayers to accept a gold watch for himself and a diamond pendant for his wife. Mr. Sayers briefly returned thanks, and commended his successor (Mr. Taylor) to the same kindly consideration which they had always shown him. The toast of "The Institution of Electrical Engineers," was proposed by the Rev. Bishop of Glasgow, who pointed out that one of the great purposes of their profession as electrical engineers was the transmission of power. He believed that the whole rural question depended upon the success of their activities. As civilisation advanced, they became less and less anxious to expend all their energies in bodily labour, and he believed that if they did not go too far in it, they were doing a very important work in securing the cheap transmission of power. They were doing much, too, to solve many of the social problems, and he wished they would not confine their energies altogether to the transmission of force. He would like if they would transmit force in terms of character. Mr. Duddell, the President of the Institution, in his reply, assured the Lord Bishop that they wished to push out the boundaries of the application of electricity as far as possible. They were particularly anxious to give the agricultural labourer cheap power for his work, and by carrying their work into the country districts, they would relieve their smoke-laden cities. As to their work on the modern battleship, he believed the members of their Institution would be willing and able to do their duty both in peace and war. They sought to transmit power, and they were also able, by electrical energy, to transmit intelligence. With regard to the supply of cheap light, their stations had recovered from the temporary setback, due to the introduction of the 1-watt lamp. The 1-watt lamp had enabled them to reduce the price of electrical energy for lighting and the ½-watt lamp would enable them to lower it still further. Mr. J. E. Kingsbury gave the "Scottish Local Section," and the chairman, in acknowledging, said that by reading and discussing papers at their local centres, they had not only obtained a better knowledge of many subjects relating to their industry, but they had developed a better understanding among the members in the different branches of the profession. Two years ago they had changed their name from the Glasgow Local Section to the Scottish Local Section, and since then they had divided their meetings between Glasgow and Edinburgh. Some of them felt that this broke the continuity of the session, and they therefore proposed to have two additional meetings in Glasgow this session, one of these meetings being in the nature of an informal discussion. It had been suggested that they should have permanent accommodation of their own in Glasgow, including a library of technical works, which would be open on certain nights of the week. With regard to the broader policy of the Institution which sought to bring into line all the various interests, scientific, technical, commercial, this appealed to them in Glasgow where they had shipbuilding, marine engineering, steel manufacture and coal mining, in all of which electricity was playing an ever more important part. If their Institution was to continue to be truly representative of the whole industry, it should be flexible enough to bring within its membership and control all the various applications associated with these different industries. While they should keep up the status of their membership, they would like all those associated with their industry to qualify themselves for membership in one or other of their various grades.

The annual dinner of the NEWCASTLE SECTION of the Institution was held in that city on the 16th inst. Mr. Charles Vernier, the chairman of the Local Section, presided, and the chief guest of the evening was Mr. W. Duddell, F.R.S., President of the Institution, while others present included the Lord Mayor (Mr. Johnstone Wallace), the Sheriff (Mr. H. Shaw), Sir Charles Parsons, &c. Mr. P. V. Hunter proposed "The Commerce and Industry of the North-East Coast." He said that while it was a fact that a number of industries had fallen into decay, more particularly the chemical industry, electrical engineers were looking forward to the development of the electrochemical and electrothermal industry for their next big advance. He had not the slightest hesitation in saying that in a few years' time those industries would rank as the biggest as regarded the number of men employed and the value of the products. The Lord Mayor, in responding, said if he could only lay hold of some gentlemen and induce them to introduce the electrochemical and electrothermal industries on Tyneside, then he thought they would earn the gratitude of everybody, because they wanted more industries there. The Sheriff proposed the toast of "The Institution of Electrical Engineers." Mr. Duddell, in reply, referred to the utilisation of electricity in other directions than those in which it was used at present, and said the question of the use of electricity in furthering the growth of plant life was a serious one, as well as a real one. Sir Oliver Lodge, who was really the first to put that matter on a firm foundation, had assured him that the evidence was cumulative that they could effectually stimulate plant growth by electrifying the atmosphere. It now remained for electrical engineers to show whether that would be a profitable way of increasing the produce of their country. The future of electricity in this neighbourhood was very bright, Tyneside had led the way in England in regard to the application of electricity to power purposes, and if the figures could be maintained they would lead the way in electrochemistry and electrometallurgy. Other toasts included that of "The Newcastle Local Section," proposed by Mr. J. S. Highfield, and responded to by the chairman, who referred to the progress that had been achieved.

The section of the new General Mine Regulations relating to the use of electricity was discussed at a joint meeting of members of the Midland branch of the NATIONAL ASSOCIATION OF COLLIERY MANAGERS and of the Notts. and Derbyshire branch of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS at Nottingham, on December 6th.

THE BRITISH ASSOCIATION.—The Committee charged with the local arrangements for the recent visit to Birmingham of the British Association at its final meeting, reported that the number of persons taking tickets for the meeting was 2,635, compared with 2,504 at the Dundee meeting last year, and 2,453 at the Birmingham meeting in 1886. The extent to which the artisan classes availed themselves of the popular science lectures made them a notable feature of the meeting.

CONCRETE INSTITUTE.—In the course of his presidential address on November 13th Mr. E. P. Wells remarked that it had been the custom of several firms in this country to import what were known as foreign blooms, roll them, and sell them as English steel. It had been his lot to come across steel so made, and he found in every instance that it only came up to the foreign standard of 26 tons per sq. in., whereas the lowest limit of the British standard was 28 tons. In many cases the steel rolled in this country from foreign billets had been as low in tensile strength as 23 tons per

sq. in. He desired to call the attention of all those who were interested in steel for structural work generally and for reinforced concrete work in particular, to the fact that the tests on steel should be carefully watched.

A paper was read by Mr. W. Laurence Gadd, F.I.C., entitled Some Fallacies in Cement Testing, at the meeting on December 11th.

Association of Electrical (Station) Engineers.—A smoking concert was held at the Merchants' Hotel, Manchester, on December 10th, at which there was an excellent attendance. During the evening the members expressed their appreciation of the services to the Manchester Section of Mr. T. S. Wallis, vice-chairman, who is leaving shortly for abroad. Arrangements are being made to hold meetings at Middlesbrough and Plymouth early in the New Year for the purpose of forming branches of the Association, and dates and particulars of meetings will be announced as soon as possible.

**London Electricians' Wages Movement.**—A meeting of the Electrical Trades Union, held on Monday at the St. Bride's Institute, was much more numerously attended than the meeting at Holborn on October 28th, and the dissentients from the resolution which was carried were those who wished for immediate action to be taken. The following is the reply which was addressed to Mr. L. G. Tate, secretary of the London Electrical Masters' Association :—

"This meeting of members of the Electrical Trades Union instructs the London District Committee that they cannot accept the terms of the letter of December 8th from the London Electrical Masters' Association, and cannot enter into negotiations excepting the questions to be discussed by the suggested conference are dealt with on their merits, without any previous conditions being exacted, and without prejudice."

I would point out that our letter of November 11th to the employers, stated in moderate terms our request for an advance of wages to 11d. an hour, with an agreed-on code of working rules, and that we were desirous of coming to an amicable understanding with a body representative of the said employers, if possible. The letter of December 8th, from the Committee of the L.E.M.A., if insisted on, entirely precludes such a possibility, and so far as my knowledge extends, have never been put before, or agreed upon, by any workmen's association previous to the questions at issue being discussed.

I am to add that we are quite prepared to meet your Committee to discuss any points upon which there may be a variance of opinion, in a just and equitable manner, and trust that such a meeting will be arranged at an early date.

J. Potter, *District Secretary.*

**Manchester Electro-Harmonic Society.**—To-night at 7.30 o'clock this Society holds the third concert for the present season at the Albion Hotel, Manchester. Mr. Geo. H. Fawcus will be in the chair, and an excellent programme, with the usual ample provision for intervals, has been prepared. The artistes will be as follow :—Soprano, Madame Annie Walker; solo clarionet, Mr. Harry Mortimer; solo violoncello, Mr. Seth Lancaster; at the piano, Mr. Chas. Kelly; entertainer, Mr. Foden Williams; accompanist, Mr. A. H. P. Martin. Any of our readers who can make it convenient to be present may be assured of a very hearty welcome and a profitable evening. The Society continues to add to its membership, and is well worthy of patronage and support.

**Strike.**—With reference to the note appearing under this heading on page 967 of our last issue, we have received the following letter :—

"Our attention has been called to a note in your last issue concerning the wages paid to the workmen at the Pearl Assurance Co.'s building, and as we are the electrical contractors, we hasten to enter a complete denial of the allegation that the non-Union men are paid less than the Union men. As a matter of fact, we pay a higher rate of wages than that at present acknowledged by the Trade Union. The strike is merely one to coerce non-Union men into joining the Union.

"London, W. Duncan Watson & Co."

**Fatality.**—An inquest was held on 12th inst. in West Fife into the death of Wm. Laurenson, jun., pit roadsman, lately residing at Waverley Street, Lochore. According to the *Glasgow Daily Herald* the evidence disclosed that in the Mary Pit, Lochore, of the Fife Coal Co., an iron girder used for roof support had been crushed down by a move in the strata, and in its descent it had fractured the sheathing of a cable used for electric lighting. Laurenson had come in contact with the girder, which became alive, and before the current could be switched off death had ensued. On behalf of the Home Office, Mr. Robert Nelson, chief electrical engineer, expressed the opinion that the voltage was far too high for a lighting cable. The jury, after retiring, brought in a verdict to the effect (1) that the present high voltage should be at once reduced; (2) that in exposed and dangerous places the cable should be so constructed as to prevent an accident such as had occurred; (3) that officials who were likely to be required should receive instruction which would help to prevent accident.

**Physical Society Exhibition.**—On Tuesday the ninth annual exhibition of electrical and other apparatus organised by the Physical Society of London was held at the Imperial College of Science, South Kensington. The exhibits again showed a decrease in number, but many interesting items were shown, and will be described in our later issues. Discourses were given by Mr. Louis Brennan on experiments with soap films, and by Prof. J. A. Fleming on the vibrations of strings. There was a good attendance.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.*

**Central Station Officials.**—Mr. S. P. Cook, charge engineer at the Luton Corporation Electricity Works, has resigned his position, having obtained a similar appointment at the Regent's Park central station.

The Morecambe Council on Monday accepted the resignation of Mr. Lionel B. Hogarth, the borough electrical engineer and manager, with regret, he having been appointed borough electrical engineer at Whitehaven. Mr. A. W. Annetts, chief assistant, has been appointed borough electrical engineer, and Mr. Hogarth is to be retained as advisory engineer to the Corporation for a period of three months from January 1st next.

Mr. H. Wallis, of Northwich, has been appointed switchboard attendant at the Portsmouth Corporation electric lighting works, to fill the vacancy recently announced.

The Swinton and Pendlebury (Lancashire) D.C. has increased the salary of its electrical engineer (Mr. Busbridge) from £161 to £180 per annum.

The Great Yarmouth T.C. has increased the salary of the electrical engineer, Mr. Gordon Bryant, from £400 to £450, from September 29th last, with a further increase to £500 in September next.

Mr. Reginald F. Rampe is severing his connection with the Stoke Newington Borough Council in order to take a more responsible post with Messrs. Pearsons, Ltd.

Mr. W. Garner-McLean, chief assistant power and distribution engineer to the London United Tramways, has resigned his position in order to take up an appointment in India, and was on the 8th inst. presented by the staff with a case of drawing instruments, a pipe and cigarette tube.

Mr. R. Norman Cole has been appointed assistant engineer at the Fareham electric light station.

The Bristol electricity works staff has presented Mr. A. J. Ostler, station superintendent, with a smoker's cabinet, on the occasion of his marriage.

**Tramway Officials.**—The Ramsbottom D.C. has increased the salary of Mr. Jas. Wild, inspector in charge of the railless cars, and he is in future to be designated manager.

Mr. C. Lucey, of Messrs. Crompton & Co., Ltd., Chelmsford, has been appointed to take charge of the lighting department of the General Electric Co. at Manchester. He took up his duties on December 15th.

## CITY NOTES.

### Barcelona Traction, Light and Power Co., Ltd.

The interim report, as appearing in the *Financial Times*, states that the company was formed for the purpose of the development of hydro-electric powers in the north of Spain and the exploitation of electric light and power business in the Province of Cataluna and surrounding territory. This enterprise has for its basis the development of various water powers on the River Ebro and its tributaries, the Rios Segre and Pallaresa. The company was formed in September, 1911, under the laws of Canada, with a capital stock of $25,000,000 and an authorised bond issue of £5 000 000, which has since been increased and fixed at £8 000.000. In June, 1913, the capital stock was increased to $30,000,000, and at the present time there is $27,450,000 of ordinary stock outstanding. In July, 1913, preference shares were created to the extent of $12,500,000, of which $10,000,000 have been sold, and the proceeds, so far as the instalments are paid, applied to the development of the company. For the purpose of carrying out its programme in Spain, a company called the "Ebro Irrigation and Power Co., Ltd." was formed under the laws of Canada with a capital stock of $2,500.000, which is entirely owned by the Barcelona Co., and it is through this company that all of the Barcelona Co.'s operations are carried out in Spain. The Ebro Irrigation and Power Co., Ltd., has been legally protocolised in Spain, and is authorised to carry on business in that country by virtue of a decree on December 14th, 1911, under the name of "Riegos y Fuerza del Ebro, Sociedad Anonima." For the purpose of carrying out the enterprise, the Ebro Co. has acquired the rights enjoyed by the company called "Saltos del Segre," by virtue of a Royal Decree dated May 14th, 1912, and also has acquired the concessions of Don Domingo Sert Badia for the utilisation of the waters of the Rio Noguera Pallaresa, unified under a Royal Decree dated March 8th, 1910. These rights have been assigned to the Ebro Co. and directly vested in that company by Royal Decree dated November 28th, 1912. After dealing in detail with the progress of construction work, the report states that on September 30th, 1913, the various companies controlled by the Ebro Co. had the following business connected and under contract :—Barcelona Co., 30,432 contracts for 78,164 H.P., or 57,428 KW.; subsidiary companies, 15,079 contracts for 19,600 H.P., or 14,426 KW.; Tibidabo, 4,607 contracts for 5,569 H.P., or 4,099 KW. Total, 50,118 contracts for 103,333 H.P.,

or 75,953 KW, and it was estimated that there were at least an additional 50,000 H.P. that could be contracted for as soon as the company was ready to supply the power. The above figures do not include the power which will be supplied to the tramways company, and which it is estimated will amount to at least 4,000 H.P. in 1914, or that required for the operation of the Ferrocarriles de Cataluna, which it is estimated will amount to 3,000 H.P. The Ebro Co., in addition to these small contracts, has also an important contract with the Sociedad Iberica del Azoe for the supply of 75,000 H.P., of which 25,000 H.P. will be supplied in 1915 and the remainder in 1918 upon the completion of the Ebro installation at Fayon. The Ebro Co. should have at its disposal in 1914 for distribution the following amounts of energy:—Steam station, 60,000,000 KW.-hours; Seros, Pobla and Talarn stations, 115,000,000 KW.-hours; total, 175,000,000 KW.-hours. The estimates of net revenue from operation from 1914 to 1917 are as follows:—1914, £546,000; 1915, £743,000; 1916, £1,050,000; 1917, £1,257,000. On account of the many unavoidable delays, due to the difficulty of getting the work started in Spain and securing the necessary permission and approval of plans from the various authorities and departments of the Government, to the time occupied in the expropriation of lands, and to the difficulties of transportation of machinery and materials, which was also a serious problem in the beginning and required some time to solve, the works in Spain are taking a longer time to carry out than was first contemplated, and consequently the earnings formerly estimated for 1914 will not be fully realised.

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**Prospectuses.**—*Tramways, Light and Power Co., Ltd.*—The subscription list was to close on Wednesday in an issue of £200,000 5 per cent. debenture stock at 98 per cent. Just over a year ago the company issued 300,000 £1 6 per cent. preference shares, and the proceeds were applied in acquiring the properties then mentioned, and towards the construction of the Nottinghamshire and Derbyshire tramways and equipment and development of the power companies. On July 1st, 1913, the company acquired all the share capital of the Midland E.L. & P. Co., Ltd., who own the Leamington lighting undertaking. The prospectus states that the proceeds of the present issue of the debenture stock will provide sufficient funds to pay for the latter property, to complete all construction works now under contract, and to satisfy the company's obligations under all existing contracts. The total capital expenditure on the various properties, inclusive of the proceeds of the present issue, will be in excess of £750,000. Messrs. Balfour, Beatty & Co., Ltd., in whose hands is the operating management of the different properties, say that the present rate of earning is sufficient to cover the interest on the £200,000 debenture stock more than twice over.

*Whitstable Electric Co., Ltd.*—This company has recently issued a prospectus locally inviting applications for 14,000 £1 shares.

*South Staffordshire Mond Gas (Power and Heating) Co.*—£100,000 5 per cent permanent debenture stock has this week been offered at 95, and 7,500 6 per cent. cumulative preference £10 shares.

**Blackpool and Lytham Tramways Co., Ltd.**—The annual meeting of this company was held on December 15th. The annual report submitted showed a total income from traffic of £35,284. From this had to be deducted £6,895 paid to Blackpool Corporation, leaving £28,389. £757 was also received for advertising, bringing the total revenue up to £29,146. Traffic expenses amounted to £5,176; general expenses, £4,143; general repairs, £7,794; power expenses, £4,815; rent of leased lines, £2,161; leaving a balance of £5,056. The balance of profit and loss account was £34,103. The directors referred with regret to the death of the chairman, Mr. T. Blane, who had been a director of the company since its formation, and chairman for 11 years. The trustees for debenture-holders intimated their intention of paying 2½ per cent. interest on account of the arrears of interest due on debenture stock.

**Yorkshire (West Riding) Electric Tramways Co., Ltd.**—The directors have decided to pay, on account of the dividend accrued to December 31st, a dividend for the half-year on the 6 per cent. cumulative preference shares at the rate of 5 per cent. per annum, making 4 per cent. for the year.

**Victoria Falls and Transvaal Power Co., Ltd.**—The directors have declared a six months' dividend at the rate of 6 per cent. per annum on the preference shares, making the cumulative dividend paid up to June 30th, 1912.

**Electrical Securities Trust, Ltd.**—According to the *Financial Times*, the accounts for the year ended November 14th show a loss, after charging debenture interest, &c., of £1,061, increasing the debit balance brought forward to £69,086.

**Marconi Wireless Telegraph Co., Ltd.**—An interim dividend of 10 per cent. upon the ordinary shares has been declared on account of the current year, payable on January 31st.

**Marconi International Marine Communication Co., Ltd.**—An interim dividend of 5 per cent. is declared on account of the current year.

**Eastern Telegraph Co., Ltd.**—A third quarterly interim dividend of 1¼ per cent. on the ordinary stock is announced in respect of profits for the current year.

## Manx Electric Railway Co., Ltd.

COLONEL SIR ARTHUR G. BOSCAWEN, M.P., presided at 3, Finch Lane, E.C., on Tuesday, over the meeting of this company.

In moving the adoption of the report (see ELEC. REV., p. 972) the chairman first apologised for the absence of Sir W. H. Vaudrey, through illness, and of Mr. Ernest Scheck through a family bereavement. He congratulated the shareholders on a very good year—in fact, a record-breaking year. The cause of this to a great extent was the fine weather during the summer, and partly also the fact that trade conditions in the North had been very good, and their patrons, who came largely from these districts, were well provided with money. Given those conditions their undertaking was, to say the least, as popular as it had ever been, as would be seen from the figures. The passenger receipts amounted to £36,642, as against £30,290 in 1912 and £32,545 in 1911, which latter was the previous best year. Goods, live stock, quarries and sundries brought in £3,518, as against £4,082 in 1912 and £3,468 in 1911. They carried 704,188 passengers, as against 574,187 in 1912, and 606,497 in 1911. Their mile ge this year was 364,747, as against 325,647 in 1912 and 344,968 in 1911. They earned 24·11d. per mile run from the passengers, as against 22·33d. in 1912 and 22·64d. in 1911, and they carried 1·93 passengers per mile, as against 1·76 in the two previous years. The number of visitors to the island, as officially indicated between May and September, was 629,617, which was 122,000 more than the previous year, and 78,000 more than in 1911. He had worked out the figures of the passengers carried in the season between May and September, and the number of visitors coming to the island, and it gave the curious result that there was hardly any difference during the three years in the amount they received from each visitor, and it was, therefore, mainly numbers which told. He believed he was right in saying that the island itself had participated generally in the good season. The Villa-Marina, which opened in the summer, had some effect on the results obtained, and he thought the Corporation of Douglas had been very wise in acquiring and laying out the property in the very attractive way they had done. So far as the company was concerned, they always heartily welcomed any scheme which was likely to attract and keep visitors. Their gross revenue amounted to £40,160, against £34,375 in 1912, and £36,013 in 1911. Their working expenses were £18,740, as against £17,669 in 1912, and £17,214 in 1911. The increase was over £1,000 more than last year, which was partly accounted for by the increased mileage run, but chiefly by the fact that their fuel was very much more expensive, and owing to the dry summer they had to run on steam to a greater extent than the year before. In spite of these adverse circumstances the ratio of working expenses to receipts was this year as low as 46·66 per cent., as against 51·4 per cent. in 1912 and 47·78 per cent. in 1911, which, he thought, they would agree was a more healthy and gratifying sign. After providing for the debenture interest and the interim dividends of the preference shares, they were left with a balance of £9,760, which they proposed to allocate as follows:—To the balance of the preference shares dividend, £3,580; reserve for special renewals, £2,000; dividend at the rate of 2 per cent. on the ordinary shares, £2,000; and to carry forward £2,179.

MR. B. E. GREENWELL seconded the motion.

MR. KIDSON congratulated the board on the results, and expressed the hope that they would have the same favourable weather conditions next year.

The report was then adopted, and the retiring directors were re-elected.

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**Official Announcements re Companies.**—The following companies will be struck off the Register at the expiration of three months, unless cause is shown to the contrary:—

Auto Conveyors.
British Electrics (Moseley's Patents).
British Patent Tube Cleaning Syndicate.
Davies Patent Boiler.
Ecco Battery and Electrical Co.
Hunslet Electrical Pottery Co.
Madeira Electric Lighting Co.
Monitor and Ajax Traction.
Mutual Electricity Supply Co.
Premier Electric Lamp Co.
"Simplex" Arc Lamp Syndicate.
Towers Lift Co.
Westminster Automatic Telephone Syndicate.

**Stock Exchange Notices.**—The Committee has ordered the undermentioned to be quoted in the Official List:—

Victoria Falls and Transvaal Power Co., Ltd.—Further issue of 162,000 preference shares of £1 each fully paid, Nos. 1,838,001 to 2,000,000.

**Lima Light, Power and Tramways Co.**—The directors have declared a dividend of 1 per cent. for the quarter ended September.

**Bullers, Ltd.**—The directors' report for the year ended July 31st, 1913, shows a profit of £17,560, plus £498 brought forward, making £18,058. A dividend of 5 per cent. on the ordinary shares is recommended.

**Globe Telegraph and Trust Co., Ltd.**—A quarterly interim dividend of 2s. per share on the ordinary shares is announced.

**Winnipeg Electric Railway Co.**—A dividend at the rate of 3 per cent. for the quarter ending December 31st, 1913, is announced.

## British Columbia Electric Railway Co., Ltd.

The directors in their report for the year ended June 30th, 1913, state that it has been one of difficulty and disappointment, mainly owing to the continued rise in the cost of operation and in the cost of all descriptions of supplies. Increased working expenses have absorbed practically the whole of the large increase in gross earnings, in spite of continuous effort on the part of the management and of the directors to economise. One of the causes of the increase in expenses has been the protracted and stubborn strike in the coal industry which existed throughout the year. This strike resulted in a considerable rise in the cost of coal, and necessitated the purchasing of supplies in the States and in Australia. The expensive working conditions still continue and are affecting the current year's earnings. Moreover, the gross receipts of the railway have fallen off owing to the depression which is prevalent in British Columbia. The directors have undiminished faith in the future of British Columbia, and consequently of the company, and meanwhile have confidence that, by a small increase recently made in the fares and by rigid economy, they will be able to maintain the present dividend basis. For the twelve months to June 30th, 1913, the gross receipts show an increase of $1,035,869, or over 17 per cent., and the net earnings, including income from investments and subsidiary companies, and after charging renewals, show an increase of $77,552, or 4 per cent., over the preceding year, but the surplus over the amount required to pay interest and dividends has fallen from £67,670 to £28,242. The money actually expended up to June 30th, 1913, amounted to $45,168,312, and the amount paid out in interest and dividends for the year amounted to $1,888,139, equal to 4.18 per cent. on the entire investment. The following charges have been made against the revenue account of the year, viz.:—Provision for renewals maintenance (from which £40,103 has been deducted for adjustments and expenditure on renewals during the year), £140,654; amount added to capital amortization, £2,361; the net profit of the year, after making the above deductions, amounts to, £381,425, plus £7,732 brought forward. Deduct interest on debentures and debenture stock to June 30th, 1913, £125,182, dividends already paid—on 5 per cent. cumulative perpetual preference stock for the year to June 30th, 1913, £60,000, on preferred ordinary stock for the year to June 30th, 1913, £72,000, on deferred ordinary stock for the six months to December 31st, 1912, £48,000, leaving available for further distribution and reserve, £83,974. From this the directors have recommended the payment of a dividend on the deferred ordinary stock at the rate of 8 per cent. per annum for the six months ended June 30th, 1913, making 8 per cent for the year, £48,000. There is to be transferred to reserve fund, £26,455, and £9,519 is to be carried forward.

There has been added to the reserve fund £67,544, representing the premiums or amount by which the price paid into the company's treasury exceeded the par value of £1,320,000 new share capital issued during the year, less expenses thereon, and after deducting the expenses and discount on an issue of £750,000 4½ per cent. debenture stock issued in January last. After the transfer now recommended by the directors as above, the reserve fund will amount to £553,000. The growth of the company's enterprise is indicated by the following figures:

| Miles of Single Track in Operation. | | Total Cars of All Classes. | |
|---|---|---|---|
| 1909 .. .. .. .. | 97·74 | 1909 .. .. .. .. | 248 |
| 1910 .. .. .. .. | 141·65 | 1910 .. .. .. .. | 427 |
| 1911 .. .. .. .. | 233·65 | 1911 .. .. .. .. | 647 |
| 1912 .. .. .. .. | 285·75 | 1912 .. .. .. .. | 725 |
| 1913 .. .. .. .. | 357·82 | 1913 .. .. .. .. | 873 |

The number of passengers carried during the year was 71,973,822, an increase for the year of 9,819,656. The number of lamps in use at June 30th, 1913, was 920,916, an increase for the year of 185,490. In the monthly statement of earnings issued since the 1st July of the current year the actual profits of the subsidiary companies have been included in the total income. Owing to the practical completion of the hydro-electric installation at Lake Buntzen, it is now possible to ascertain with accuracy the cost of power. In the past the price charged to the railway for power by the Vancouver Power Company had to be fixed somewhat arbitrarily, owing to the continually varying amount of the capital invested in the hydro-electric installation. The railway has benefited at the expense of the power company, as the price charged was too low. This accounts to a large extent for the apparently unsatisfactory yield obtained by the company in the past from its investments in its subsidiaries. In June last Mr. Blundell Brown and Mr. Harvey paid a visit to British Columbia, and during a stay of nearly three months thoroughly investigated existing conditions and future prospects. They report very quiet conditions of trade in the province, and a noticeable reaction from the progressive prosperity which has been so marked a feature of the past ten years. They believe that the existing depression is almost entirely due to the prevailing stringent monetary conditions and that it will be dispelled by the return of confidence in Canadian undertakings and in the stableness of the market for Canadian securities resulting from the continuous adoption of careful methods of finance. The dam and other works at Lake Coquitlam, which have been under construction for three years, were completed in July last. The satisfactory construction of these works reflects the highest credit on Mr. Conway, the company's chief engineer, and on his assistants, and the directors are glad to take this opportunity of publicly acknowledging their valuable services. The completion of the dam marks an important epoch in the company's history, providing as it does an available reserve of over 57,000,000 k.w.h. of electrical energy. With the power secured from the Western Canada Power Company, referred to below, the company is now placed in an exceedingly strong position in this respect. The new power house at lake Buntzen has been completed, and the first of the three additional units to be installed therein is now in operation. The erection of the second and third units is being considerably delayed, owing to the difficulty of obtaining deliveries from the manufacturers, but it is anticipated that these units will be in operation during the early part of next year. As previously announced by the directors, a satisfactory contract has been entered into with the Western Canada Power Co., under which the company agrees to purchase a gradually increasing amount of power during the next twenty years. The extension of the Jordan river hydro-electric power installation has been proceeded with during the year. To secure the necessary water storage for supply to the additional units a permanent reinforced concrete dam of the Ambursen type has been completed. By the completion of this dam the total maximum available water storage is increased to 927,900,000 cubic feet, equivalent to a reserve of approximately 14,500,000 k.w.h. of electrical energy. The electric plant at Jordan river has at present a capacity of 12,000 h.p. A third unit is now in course of installation, bringing up the capacity to a total of 25,000 h.p., which is required to meet the demand in the city of Victoria and the surrounding districts. During the year the installation of the auxiliary steam plant, which at the date of the last directors' report was under construction at Brentwood bay, 12 miles from Victoria, has been completed and has a present capacity of 6,000 h.p. The plant has been designed on the most modern and up-to-date lines, and is held in reserve to meet the possible emergency of a breakdown in the other power plants of the company on Vancouver island. In June last the new Saanich suburban line was formally opened for traffic. Sir Richard McBride, the Premier of British Columbia, in the presence of a most representative gathering, performed the opening ceremony, and drove the last spike. The line, which is approximately 23 miles in length, runs as nearly as may be through the centre of the Saanich peninsula, and opens a very fertile tract of country hitherto without satisfactory connection with the City of Victoria. The directors again have pleasure in expressing their appreciation of the loyal and satisfactory services rendered by the management and staff in British Columbia.

| Year ended June 30th. | Income after charging renewals maintenance. | No. of passengers. | No. of lamps in use. | Balance available for dividend. | Rate of div. paid per annum. Pref. ord. s'ock. | Def. ord. stock. | Amount taken to reserves. |
|---|---|---|---|---|---|---|---|
| 1910 .. | 226,803 | 34,476,804 | 439,315 | 189,391 | 6 % | 8 % | 108,765 |
| 1911 .. | 302,993 | 46,541,448 | 763,542 | 198,455 | 6 % | 8 % | 158,571 |
| 1912 .. | 385,846 | 62,154,166 | 735 426 | 257,670 | 6 % | 8 % | 197,391 |
| 1913 .. | 401,836 | 71,973,822 | 920,916 | 256,242 | 6 % | 8 % | 196,911 |

## Burmah Electric Tramways and Lighting Co., Ltd.

Mr. DAVID C. ELLIS presided on Friday, Dec. 5th, at the offices, 1, Queen Victoria Street, E.C., over the meeting of the company. He first apologised for the absence of Mr. E. C. Morgan, the chairman. The revenue account showed by far their best result for a year's working. The earnings, before setting aside any sum to reserve, amounted to £7,575, as against £3,748 for the previous year. This improved result was attributable to the increase in receipts from both traffic and light and power supply, and the saving in power generation expenses due to the use of the Diesel engine in the place of the steam set. Whilst congratulating the shareholders upon the improved results, and expressing the hope that this progress might continue, the extent of such improvement must depend upon a continuance of the generally good conditions which had prevailed for the past year. The company started without a penny of working capital, and it had been necessary to carefully husband its resources in order to reach the present position. As a consequence of this policy they would have sufficient funds in hand, after paying for the new Diesel set and the proposed dividend of 3 per cent., for current working capital, and subject, therefore, to the provision each year of a reasonable sum for depreciation, the balance will be available for distribution in dividend to the preference shareholders. The company's manager in Mandalay, Mr. A. C. Morgan, retired on the termination of his agreement, on the 31st October. Mr. Morgan joined the service at the commencement of the company's operations, as assistant manager, and since August, 1908, had been in charge. The directors desired to place on record their appreciation of the excellent services rendered by Mr. Morgan during the whole of this period. As the system was now thoroughly well organised, the directors had not filled the vacancy, and the duties in future would be carried out by their present chief engineer, Mr. A. H. Burbidge, under the title of chief engineer and manager. It had been their intention to transact the ordinary business of the meeting before dealing with the scheme put before the shareholders in connection with the arrears of preference dividend, but in view of the opposition to the scheme which had since developed among a number of the larger

shareholders who had lodged proxies representing £31,240 preference capital, sufficient to negative the resolution for carrying the scheme into effect, the board did not now consider it necessary to waste the time of the shareholders in holding the separate general meetings. He might add that they had received proxies representing £38,410 preference capital in favour of the scheme. They felt, however, that it was due to the shareholders, no less than to themselves, that they should give some further explanation of their reasons for putting forward the scheme, in view of the criticisms which had appeared in the Press suggesting that it was prepared in favour of the ordinary against the preference shareholders. In the first instance the object of the directors in dealing with the matter at all was to enable the company to start with a clean slate on its new career as a dividend paying concern. The proposed scheme might not be the best that could be evolved, but it was a genuine attempt to hold the scales evenly between the two classes of shares, and certainly, in their opinion, effected this object better than any of the alternatives that had been suggested to them. It was difficult in the small compass of a circular to set out the whole of the considerations dealt with, but shortly the position was this:—The preference dividend was in arrears eight and a half years, say 51 per cent. Under the articles the arrears of preference dividend ranked as capital on the sale of the business on liquidation or otherwise. The profits of the company to the 31st July, 1913, amounted to £7,575, and after providing for depreciation and renewals, there would have been left about £4,500 net profit available for dividend on the preference shares this year. The manager, in commenting on the year's working, pointed out that the improved result was to a great extent due to what he considered exceptional conditions, and warned the board not to anticipate a corresponding increase in the future. This warning was obviously given to prevent an exaggerated and unsafe estimate of the earning capacity of the undertaking being made. Under these circumstances, the possibility of the arrears of preference dividend being paid out of the earnings appeared remote, and consequently the chief value of these arrears consisted in the capital value provided under the articles. This value was preserved under the scheme. The net earnings of the company would have to show an increase of £1,500 above the profit made this year before the full interest of 6 per cent. would be available. There was no object in wiping out the arrears of interest if a further accumulation were to commence at once, and consequently it was suggested under the scheme that for the future the dividend on the preference shares should be non-cumulative, but in order that they should be entitled to receive the advantage of any exceptional profit that might be earned in any one year it was proposed that the interest should be increased from 6 per cent to 7 per cent. It would be seen, therefore, that under the scheme the capital rights to the arrears were protected and the preference shareholders would have received the whole of the net profit of the company in dividend unless the company should earn profits in the future far in excess of any estimate that could have been formed on the facts to-day. As he had already told them, the directors did not propose to put the resolutions set out in the notices, and they had decided that, under the circumsances, it would be better to let matters remain as they were for a year or two, in order that the earning capacity of the system might be more definitely ascertained.

Mr. F. C. Kennedy, C.I.E., seconded the motion.

Mr. Gaunt pointed out that the company had cut down its fuel bill by the installation of the Diesel plant, and it seemed to him that if they were to do anything with the company they must have savings in all directions. He had taken out the figures for the last six years in regard to the expenditure on cars and the electrical equipment of cars, and he found in six years it had cost £491 per car. This seemed to him enormous. When he drew attention to it before Mr. Morgan told him that the climate was such that it damaged everything, but he did think something might be done to lessen the outlay. He had come prepared to say some straight things about the scheme, but as it had been withdrawn there was no need to say anything.

Dr. Moody congratulated the board on the improved earnings of the company, and said he believed that the earnings in the current year were above those of the past year. He was glad the board had withdrawn the scheme, but regretted they did not do it earlier.

Dr. Pollan also expressed his feeling that the board had done well to withdraw the scheme. He knew something of the damage which the Indian climate did.

Mr. Fleming spoke at some length on the various suggestions which had been made for dealing with the arrears, and said that personally he had no objection to the scheme of the board. He felt that the preference shareholders ought to have control of the company, and that it would be a good thing if they could get a modern electrical tramway expert to join the board as the representative of the preference shareholders.

Mr. Clifford Johnson endorsed the suggestion of having an electrical expert on the board.

The Chairman said the board would take special care to enforce every possible economy. The cars were put on the road many years ago, and in a tropical climate they had to spend a good deal of money in keeping them up. The directors would give earnest consideration to the suggestions made, but as regards an electrical expert that would be an expensive matter, and he hardly thought an expert would give his time for the fees the directors received.

The report was adopted.

Replying for his re-election as a director, the Chairman pointed out that the gentleman who had been appointed manager had had a thorough experience of tramway working in this country, and they had every confidence that he was perfectly up to date.

## Melbourne Electric Supply Co., Ltd.

The fourteenth annual general meeting was held on Monday at the offices, Finsbury Pavement House, E.C., Mr. J. B. Braithwaite presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, p. 969), said that again he had to congratulate the shareholders upon the steady progress which the company was making. Last year he had to congratulate them upon what was really a record progress which he did not believe could be matched by any company in the world that he was aware of, certainly not in England or Australia, and one would hardly have expected that the progress for the past year would have equalled that of 1912. They would, however, see from the report that the past year had been a year of even greater expansion than its predecessor. When they came to think that in Melbourne every week during the past year they had rendered a supply available in two miles of additional streets, they would see the activity which had been going on in their mains extensions. They had an increase of nearly 56 per cent. in the number of consumers, which was nearly half as much again as the increase in the previous year. He did not think that any other company could show anything like an addition of 100 new consumers every week as they did. The power supply had increased by 28 per cent.; that again was very satisfactory, and owing to some revisions in the tariff which they had recently made, they were likely to secure in the future power consumers of a larger character. The figures showed how very closely the sale of current had increased with the increase in consumers; every new consumer had been an active consumer who had begun to take current from them. That expansion of business could not be conducted without further capital expenditure, and they had to spend considerable sums of money on the extension of the power house. They had put in two additional 5,000 k.w. turbines, which he believed were the largest units which had yet been established in Australia. The additional capital expenditure at Melbourne had been £140,154, whilst at Geelong, including the tramways, they had had to spend an additional £20,000, making their total capital expenditure during the year £160,000. If the present growth of business continued they would have to increase their capital outlay still further in the future. They had carefully considered the question, and at present their idea was to ask the shareholders to increase the capital by £300,000; £200,000 of which would be in consolidated ordinary stock, raising it to half-a-million, and £100,000 in 7 per cent. preference shares, raising them to a quarter-of-a-million. That would give them power to issue a further quarter-of-a-million consolidated debenture stock, which would enable them to energetically develop the business. In view of the fact that a large portion of the share capital was now held in Australia, they proposed to give such notice for the necessary increase of capital as would enable their Australian shareholders to give their opinions on the matter. They intended in the first instance to offer the new capital to the existing shareholders in proportion to their holding. With regard to the debenture stock they would adopt the same plan as last time, and offer the sum by cable to Australian shareholders in case they cared to take any. When the ordinary stock came along there ought to be a considerable profit to be made by taking it, and they would see to it that the Australian shareholders were given the chance of securing the benefit. They would see that the larger units of plant which they were now putting in, were securing larger economies in their works' costs, so that their net profits were more than keeping pace with the additional capital. Their profit during the last year from Melbourne and Geelong was £77,000, as compared with £56,000 the previous year, an increase of 37 per cent., or, to put it in another way, £21,000 more than last year on an additional capital expenditure of £160,000, all of which of course had not as yet become remunerative. Referring to the proposed addition of £5,000 to the general reserve, raising it to £60,000, the Chairman said it was their policy to create a general reserve, and not specifically allocate it for depreciation. The extraordinary growth of the business was clearly set forth in the tables in the report. In Melbourne the number of consumers had increased from 733 in 1904, to 13,571 last year; lighting in k.w. from 1,034 to 12,139; the motors in rated h.p. from 445 to 9,581; the total connections from 1,461 k.w. to 21,720 k.w.; the total units sold from 720,817 to 9,740,194, and the gross profit from £3,460 to £68,581. The same thing applied on a smaller scale to Geelong. There the number of consumers had increased from 330 in 1904 to 1,456; the lighting from 313 k.w. to 1,734; the motors from 297 h.p. to 1,846 h.p.; the total connections from 598 k.w. to 3,580 k.w.; the total units sold from 207,125 to 1,034,052, and the gross profit from £813 to £8,511. They had not yet been able to complete the tramway scheme in Geelong owing to various delays, but in spite of that fact they

had carried the whole population something like forty-two times over during the year, which was very satisfactory, showing that the tramways were being increasingly appreciated. He might say that they had 7 cars, 4 trailers and 3 motor 'buses, and the length of the track was about 4¾ miles. The total number of passengers carried was 1,074,000. When the track was finished, which they hoped would be very shortly, they were told that they might expect a very considerable increase in the receipts.

Mr. W. Parker seconded the motion.

Mr. G. E. Goodhart said that he had come from Australia to voice the views of some of the colonial shareholders in regard to several matters affecting their interests. In the course of a long statement Mr. Goodhart said that the shareholders on the other side wished to have an assurance from the board that in the event of any further increase in the capital they should have a prior right to subscribe. The Australian shareholders would also be glad if in future they could receive notice of the meeting sufficient time beforehand to enable them to lodge proxies in London should they so desire. They would also like to know at what price the board proposed to issue the new stock.

The Chairman, in reply, said that he thought he had made it quite clear that in the issue of any fresh capital the present shareholders would have a prior right to subscribe. They could not at the moment expect him to say at what price the new shares would be issued, but he might say that their idea at present was to issue the ordinary stock at par, and with regard to the preference they might consider it their business to issue it at a premium. With regard to the other point raised by Mr. Goodhart, the board would consider whether it was possible to do as he suggested, but the difficulty was that their accounts did not close until August and they must hold the meeting sometime in December.

The report was adopted.

## Costa Rica Electric Light and Traction Co., Ltd.

The Directors' report for the year ended 30th June, 1913, says that the net earnings in Costa Rica, after charging all expenses incurred, amounted to £23,875, as compared with £22,034 for the previous year, being an increase of £1,842. The net surplus profit for the year was £7,338 (against £5,732 last year), and the directors propose to carry the whole of this amount to the credit of "Discount and Commission on Debenture Issues" account. The number of lamps installed in the lighting department increased by 10 per cent. during the 12 months, and the motor supply by 43 per cent. The power plant at El Brasil, inaugurated in December, 1911, has worked throughout the year without a hitch, and the second pipe line, referred to in last report, has been a great source of security in the continuity of supply. The machinery for the fourth 500 k.w. set is on order, and delivery is expected early in the coming year. The question of electrical cooking has occupied the attention of the board during the past year, and the directors hope that a considerable business will be built up in connection therewith. There are already 60 customers using electrical energy for cooking, and the number is increasing month by month. The management of the business in Costa Rica continues to give every satisfaction. During the year the gold premium has averaged 112¼ per cent., as against 112½ per cent. for the previous year. The general manager certifies that all buildings, machinery, plant, and permanent way, have been kept in good working order. The insurable buildings, machinery, and rolling stock are adequately covered against risk from fire.

The meeting will be held in London, next Monday.

## STOCKS AND SHARES.

Tuesday Evening.

Markets round the Stock Exchange cannot complain that they are being overworked. In fact, they have very good reason for a lament in the opposite direction. Consols keep on crumbling in uncomfortable fashion, although conditions in the money market are not as stringent as is usually the case at this particular season of the year, but at the same time, to wish a member of the Stock Exchange "A Merry Christmas" will be to invite reprisals, and this friendly hint is thrown out with a view to saving unpleasant consequences to well-meaning friends of the said members, who might be tempted otherwise to run into danger in their seasonable exuberance of sentiment.

The chief point of interest is that concerning the County of London Electric Supply Company's action with regard to the Bill which it intends to promote in next session's Parliament, upon modifications of the purchases clauses by the London County Council.

One enterprising newspaper early this week published most of the contents of a letter marked "private and confidential," which was circulated amongst the directors of the various London electric supply companies. Those who were acquainted with the contents of this letter before it went out were somewhat surprised to observe the excited manner in which it was served up to the public, and we wondered whether its publication was altogether calculated to assist the cause of those who consider that amalgamation between the various interests is a desirable thing. Put briefly, the idea is to establish a holding concern, into whose stocks the existing securities could be converted. Substantial economies and largely increased revenue are expected to result from such a combination, but at present the whole matter is so embryonic that even the discussion of its possibilities—save amongst the companies themselves—appears to be as superfluous as premature.

The Stock Exchange market remained unruffled and unenthused by the announcement. The prices of the leading shares are all firm. City of London Ordinary and County of London Ordinary have assumed the lead in the market at the present time, and the former rose to 17 buyers, upon quiet absorption of a few score of shares, although afterwards sellers came in at this price. County of Londons rose ⅛, and Brompton Ordinary and Preference both improved. The feature in the provincial list was a further rise of 15s. in Hove shares, the price jumping to 9.

Inquiries as to whether it would be possible to obtain lines of shares in the London undertakings—the suggestion being, of course, that there might be an Electric Trust Company on the horizon—did not stimulate prices. We seem to remember having heard of such inquiries upon former occasions.

The Railway market unsteadied again because of the recrudescence of labour difficulties, while a further drop in the price of Consols militated against the market. Support was forthcoming, however, and on the week the changes show little significance. Districts fell ¾ to 30½, thus shedding more than their previous rise. Underground Electric Railway shares are lower, and the company's 6 per cent. Income Bonds eased off to 89. Gains of a point occurred in the Assented stocks of the Central London Railway, which had no effect upon the quotations for the non-Assenting. The Tramway group is very quiet, and not a change worth mentioning has taken place for the past week or so. The Yorkshire (West Riding) Electric Tramways has declared a final dividend for the year on its 5 per cent. Preference shares, making 4 per cent. for 1913.

Mexican news unsettled the prices of most stocks and shares connected with the country. A good deal of exasperation is felt with President Wilson at the way in which he has handled the Mexican crisis. The opinion is freely expressed in the City that, had he recognised General Huerta at the start, and given him a certain amount of backing, the revolution would have been over long before this, and the country settled down to more normal conditions. Instead of which, affairs appear to be in a more chaotic state than ever.

This is reflected in sharp falls in Mexican Light and Power issues, and in Mexico Tramways shares, the falls ranging from 1 to 3½ points. Paradoxically, Monterey Debentures are better at 60½. The Latin-Canadian group, as a whole, tends to heaviness. Shawinigan Water reacted to 137, and there are small falls in various bonds connected with this group, although Rio de Janeiro Tramway bonds are strong. Brazilian Tractions have gone back on a further severe drop in the prices of Brazil Rails. Anglo-Argentine Trams are a better market, small rises being marked in the First Preference and in the 5 per cent. Debenture stock. The report of the British Columbia Electric Railway Company came as a sharp disappointment, the net profit being substantially less than had been expected, and the Deferred and Preferred Ordinary have lost 3 and 1 points respectively.

Telegraphs and Telephones are irregular. American "Tel. and Tel." fell 10 points on New York rumours that the 8 per cent. dividend may be reduced. New York Telephone bonds drooped slightly. On the other hand, Anglo-American Telegraph Deferred rose ½ on a revival of speculative interest; the price carries the full dividend of 1½ per cent. payable next February. Globe Ordinary and Preference, both *ex* dividend, are firm, especially the latter. Marconis advanced on the declaration of an interim dividend of 2s. per share, and the Preference hardened in sympathy. Canadian Marconis remain steady at 9s. 6d.

Willans & Robinson Preference rose another 7½ points, and the company's 4 per cent. Debenture stock is up 4. It is argued that the undertaking should now make good progress under its reorganised capital. Castner-Kellners are *ex* the dividend of 2s. 8½d. India-Rubber shares lost another 10s. The raw rubber market remains unsatisfactory from the sellers' point of view, and share prices are mostly dull and depressed.

**Continental.**—France.—La Société Electrique de Perrosguires is the name of a new company, which has lately been formed in Paris (157, Boulevard Periere), with a capital of £4,000.

Russia.—A new company has just been formed in Paris with a capital of £1,000,000, and the title La Société Industrielle d'Electricité pour la Russie.

Austria.—The balance-sheet of the Vereinigte Elektricitäts Gesellschaft, of Vienna, for the last financial year shows a net profit of £33,425, as compared with only £31,037 in 1911-12. The dividend is being increased from 6 to 6½ per cent.

Spain.—At the last meeting of the Compañia Barcelonesa de Electricidad, the capital of this society was increased from 18 to 40 million pesetas, by the issue of 44,000 new shares of 500 pesetas value, which have since been all taken up by the Canadian group.—*Electron.*

# SHARE LIST OF ELECTRICAL COMPANIES.

## ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

| NAME. | Stock or Share. | Dividends for | | Closing Quotations Dec. 16th. | Rise + or Fall — | Present Yield p.c. |
|---|---|---|---|---|---|---|
| | * | 1912. | 1913. | | | £ s. d. |
| Bournemouth & Poole, Ord. .. | 10 | 6 | 5† | 9¾ — 10¼ | .. | 5 17 1 |
| Do. 4½ % Pref. .. .. .. | 10 | 4½ | 4½ | 8⅝ — 9⅜ | .. | 4 14 9 |
| Do. Second 6 % Pref. .. .. | 10 | 6 | 6 | 10 — 10⅝ | .. | 5 14 3 |
| Do. 4½ % Deb. Stock .. .. | Stock | 4½ | 4½ | 95 — 98 | .. | 4 11 10 |
| Brompton & Kensington, Ord. .. | 5 | 10 | 9† | 8¾ — 9⅛ | + ⅛ | 4 9 9 |
| Do. 7 % Cum. Pref. .. .. | 5 | 7 | 7 | 8¼ — 8½ | + ⅛ | 4 0 0 |
| Central Electric Supply, 4 % Guar. Deb. | 100 | 4 | 4 | 90 — 93 | —1 | 4 6 0 |
| Charing Cross, West End & City | 5 | 5 | 5† | 4⅞ — 5 | .. | 5 0 0 |
| Do. 4½ % Cum. Pref. .. .. | 5 | 4½ | 4½ | 4 — 4½ | .. | 5 0 0 |
| Do. "City Undertaking" 4½ % Cum. Pref. | 5 | 4½ | 4½ | 8⅝ — 4⅞ | .. | 5 9 1 |
| Do. Do. 4 % Deb. .. .. | 100 | 4 | 4 | 90½ — 92½ | .. | 4 6 6 |
| Chelsea, Ord. .. .. .. .. | 5 | 5 | 4† | 4⅜ — 5⅛ | .. | 4 17 7 |
| Do. 4½ % Deb. .. .. .. | Stock | 4½ | 4½ | 95 — 98 | +1 | 4 11 9 |
| City of London, Ord. .. .. | 10 | 9 | 6† | 16⅜ — 17⅝ | + ¼ | 5 1 5 |
| Do. 6 % Cum. Pref. .. .. | 10 | 6 | 6 | 13 — 14 | .. | 4 5 9 |
| Do. 5 % Deb. .. .. .. | Stock | 5 | 5 | 116 — 120 | .. | 4 3 4 |
| Do. 4½ % Second Deb. .. | 100 | 4½ | 4½ | 99 — 101 | .. | 4 9 1 |
| County of London, Ord. .. .. | 10 | 6 | 5† | 11⅜ — 12¼ | + ⅛ | 4 18 0 |
| Do. 6 % Pref. .. .. .. | 10 | 6 | 6 | 11½ — 12 | .. | 5 0 0 |
| Do. 4½ % Deb. .. .. .. | Stock | 4½ | 4½ | 104⅛ — 105½ | .. | 4 5 3 |
| Do. 4½ % Second Deb. .. | Stock | 4½ | 4½ | 98 — 101 | .. | 4 9 1 |
| Edmundson's, Ord. .. .. .. | £3 | .. | .. | 5/16 — 9/16 | .. | Nil |
| Do. 6 % Cum. Pref. .. .. | 5 | 6 | 6 | 3⅞ — 4⅛ | .. | 7 1 2 |
| Do. 6 % Non-Cum. Pref. .. | 5 | .. | .. | 1⅜ — 1½ | .. | .. |
| Do. 4½ % First Mort. Deb. .. | 100 | 4½ | 4½ | 80 — 88 | .. | 5 8 5 |
| Folkestone .. .. .. .. .. | 5 | 6 | 6 | 4⅜ — 4⅞ | .. | 6 3 1 |
| Do. 5 % Cum. Pref. .. .. | 5 | 5 | 5 | 4⅜ — 4⅞ | .. | 5 2 7 |
| Do. 4½ % First Deb. .. .. | 100 | 4½ | 4½ | 89 — 91 | .. | 4 19 0 |
| Hove .. .. .. .. .. .. | 5 | 9 | 8† | 8¾ — 9¼ | + ¼ | 4 17 9 |
| Kensington & Knightsbridge, Ord. | 5 | 8 | 8† | 7⅝ — 8⅛ | .. | 4 17 6 |
| Do. 4 % Deb. .. .. .. .. | Stock | 4 | 4 | 90 — 92 | .. | 4 7 0 |
| Kent Elec. Power, 4½ % Deb. .. | Stock | 4½ | 4½ | 76 — 80 | .. | 5 12 6 |
| London Electric, Ord. .. .. | 3 | 2½ | .. | 1⅛ — 1⅜ | .. | 4 12 7 |
| Do. 6 % Pref. .. .. .. | 5 | 6 | 6 | 4⅞ — 5¼ | .. | 5 14 3 |
| Do. 4 % First Mort. Deb. .. | Stock | 4 | 4 | 89 — 92 xd | +2 | 4 7 0 |
| Metropolitan .. .. .. | 5 | 4 | 4† | 3⅝ — 3⅞ | .. | 5 10 4 |
| Do. 4½ % Cum. Pref. .. .. | 5 | 4½ | 4½ | 4⅛ — 4⅜ | .. | 4 12 4 |
| Do. 4½ % First Mort. Deb. .. | Stock | 4½ | 4½ | 97 — 100 | .. | 4 10 0 |
| Do. 3½ % Mort Deb. .. .. | Stock | 3½ | 3½ | 79 — 82 | .. | 4 5 4 |
| North Metropolitan Power Supply, 5 % Mortgages (Red.) | 100 | 5 | 5 | 100 — 103 | .. | 4 17 1 |
| Notting Hill, 6 % Non-Cum. Pref. | 10 | 6 | 6 | 10 — 10⅜ | .. | 5 11 7 |
| Oxford .. .. .. .. .. | 5 | 7 | 6† | 6 — 6½ | .. | 5 7 8 |
| St. James' and Pall Mall, Ord. .. | 5 | 10 | 10† | 8½ — 9 | .. | 5 11 1 |
| Do. 7 % Pref .. .. .. .. | 5 | 7 | 7 | 6½ — 7 | .. | 5 0 0 |
| Do. 3½ % Deb. .. .. .. | 100 | 3½ | 3½ | 82½ — 85½ | .. | 4 1 10 |
| South London, Ord. .. .. .. | 4 | 5½ | .. | 2⅝ — 2¾ | .. | 6 15 4 |
| Do. 5 % First Mort. Deb. .. | 100 | 5 | 5 | 97 — 100 | .. | 5 0 0 |
| South Metropolitan, 7 % Pref. .. | 1 | 7 | 7 | 1 3/32 — 1 7/32 | .. | 5 14 9 |
| Do. 4½ % First Deb. Stock .. | 100 | 4½ | 4½ | 93 — 96 | .. | 4 13 9 |
| Urban, Ord. .. .. .. .. | £3 | Nil | .. | 5/16 — 9/16 | .. | .. |
| Do. 5 % Cum Pref. .. .. | 5 | 3 | .. | 2⅜ — 2⅝ | .. | .. |
| Do. 4½ % First Mort. Deb. .. | 100 | 4½ | 4½ | 83 — 86 | .. | 5 4 8 |
| Westminster, Ord. .. .. .. | 5 | 10 | 10† | 8½ — 8⅝ | .. | 5 14 8 |
| Do. 4½ % Cum Pref. .. .. | 5 | 4½ | 4½ | 4⅞ — 5⅛ | .. | 4 7 10 |

## COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

| | | | | | | |
|---|---|---|---|---|---|---|
| Adelaide, 6 % Pref. .. .. .. | 5 | 6 | 6† | 5⅛ — 5⅜ | + ⅛ | 5 11 7 |
| Calcutta, Ord. .. .. .. .. | 5 | 8⅓ | 5† | 7⅛ — 7⅜ | .. | 5 11 6 |
| Do. 5 % Pref. .. .. .. .. | 5 | 5 | 5 | 4⅜ — 5⅛ | .. | 4 17 7 |
| Calgary Power, 1st Mort. Bds. .. | 100 | 5 | 5 | 91 — 93 | .. | 5 7 6 |
| Canadian Gen. El. Com. .. .. | $100 | 7 | 8 | 108 —112 | .. | 7 2 10 |
| Do. 7 % Pref. .. .. .. .. | $100 | 7 | 7 | 119 —124 | .. | 5 12 11 |
| Cordoba Lt., Power and T., Ord. | 1 | 5 | .. | 7/16 — 9/16 | — 1/16 | 7 12 0 |
| Do. 5 % Deb. .. .. .. .. | 100 | 5 | 5 | 91 — 93 | .. | 5 7 6 |
| Elec. Lt. and P. of Cochabamba, 6 % Bonds | 100 | 6 | 6 | 88½ — 90½ xd | .. | 6 12 7 |
| Elec. Supply Victoria, 5 % 1st Mort. Deb. | 100 | 5 | 5 | 93 — 96 | .. | 5 10 6 |
| Elec. Dev. Ontario, 5 % 1st Mort. Bonds | $500 | 5 | 5 | 94½ — 96½ | — ½ | 5 3 8 |
| Kalgoorlie Elec. P. and L., Ord. | 10/- | Nil | .. | 3/16 — 5/16 | .. | Nil |
| Do. 6 % Pref. .. .. .. .. | 1 | 6 | 6† | 3/4 — 15/16 | .. | 11 5 8 |
| Kaministiquia Power, 5 % G. Bs. | $500 | 5 | 5 | 107½ —104½ | .. | 4 15 8 |
| Madras, Ord. .. .. .. .. | £ | Nil | .. | 1¼ — 1⅝ | .. | .. |
| Melbourne, 5 % 1st Mort. Deb. .. | 100 | 5 | 5 | 103 —106 | .. | 4 14 4 |
| Mexican El. Lt., 5 % 1st M. Bds. | .. | 5 | 5 | 68 — 73 | .. | 7 0 10 |
| Mexican Lt. & Power, Common | $100 | 4 | 4 | 43 — 47 | —5 | 8 9 6 |
| Do. 7 % Cum. Pref. .. .. .. | $100 | 7 | 7 | 78 — 83 | —3 | 8 8 6 |
| Do. 5 % 1st Mort. Gold Bds. | .. | 5 | 5 | 77 — 81 | —1 | 6 3 5 |
| Do. 5 % 2nd Mort. Bonds .. | 100 | 5 | 5 | 66 — 71 | .. | 7 0 10 |
| Monterey Rly., Light & Power, 5 % 1st Mort. Deb. | 100 | 5 | 5 | 58 — 63 | +3 | 7 16 0 |
| Montreal, Lt., H. and Power .. | $100 | 9 | 10† | 216 — 222 | .. | 4 10 1 |
| Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds | $500 | 5a | £a | 10 — 20 | —5 | .. |
| River Plate, Ord. .. .. .. | Stock | 10 | .. | 207 —217 | .. | 4 8 6 |
| Do. 6 % Non-Cum. Pref. .. | Do. | 6 | 6 | 101 — 106 | +2 | 5 13 2 |
| Do. 5 % Deb. Stock .. .. | Do. | 5 | 5 | 100 — 102 | +1 | 4 18 0 |
| Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb. | 100 | 4½ | 4½ | 99 —101 | .. | 4 9 4 |
| Shawinigan Water, Capital .. | $100 | 5½ | 6† | 135 —139 | —1 | 4 6 4 |
| Do. 5 % Con. 1st Mort. Bonds | $500 | 5 | 5 | 105½ —107½ | .. | 4 18 0 |
| Do. 4½ % Per. Deb. .. .. | Stock | 4½ | 4½ | 97⅛ — 98½ | — ⅛ | 4 11 5 |
| Toronto Power, 4½ % Deb. .. | Do. | 4½ | 4½ | 95 — 18 xd | —2 | 4 11 10 |
| Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb. | 100 | 5 | 5 | 89 — 91 | .. | 5 8 9 |
| Victoria Falls Power, Pref. .. | 1 | 6 | 6 | 13/16 — 7/8 | — 3/32 | 6 17 2 |
| West Kootenay Power and Lt., 1st Mort. 6 % Gold | 100 | 6 | 6 | 108 —105 | .. | 5 14 8 |

## TELEGRAPH AND TELEPHONE COMPANIES.

| | | | | | | |
|---|---|---|---|---|---|---|
| Amazon Telegraph .. .. | 10 | 4½ | 4½ | 6½ — 6⅝ | .. | 6 13 4 |
| Do. 5 % Deb. Red. .. .. | Stock | 5 | 5 | 96 — 97 | .. | 5 3 1 |
| American Telep. & Teleg., Cap. | $100 | 8 | 8 | 114 —117 | —10 | 6 16 9 |
| Do. Collat. Trust .. .. | $1000 | 4 | 4 | 87 — 90 | —1 | 4 9 0 |
| Anglo-American Telegraph .. | Stock | 3 | 3 | 63 — 66 | +1 | 4 11 0 |
| Do. 6 % Pref. .. .. .. | Do. | 6 | 6 | 105 —106 | + ⅛ | 5 13 9 |
| Do. Def. .. .. .. .. | Do. | 30/- | .. | 24⅜ — 24⅝ | + ⅛ | 6 0 7 |
| Anglo-Portuguese Tel., 5 % Mort. Deb. | 100 | 5 | 5 | 102 —104 | .. | 4 16 2 |
| Chili Telephone .. .. .. | 5 | 8 | .. | 7⅜ — 7⅝ | .. | 5 5 0 |
| Commercial Cable, Stlg. 4 % Deb. | Stock | 4 | 4 | 79 — 81 | .. | 4 18 9 |
| Cuba Telegraph .. .. .. | 10 | 6 | 6† | 8 — 9 | .. | 6 13 4 |
| Do. 10 % Pref. .. .. .. | 10 | 10 | 10 | 14⅜ — 15⅜ | .. | 6 9 0 |
| Direct Spanish Telegraph, Ord. | 5 | 4 | 4 | 8⅜ — 8⅝ | .. | 5 6 8 |
| Do. 10 % Cum. Pref .. .. | 5 | 10 | .. | 6⅞ — 7⅛ | .. | 6 16 0 |
| Direct United States Cable .. | 10 | 4 | 4† | 6⅛ — 6⅜ | .. | 5 18 6 |
| Direct W. India Cable, 4½ % Reg. Deb. | 100 | 4½ | 4½ | 98 —100 | .. | 4 10 0 |
| Eastern Telegraph, Ord. Stock | Stock | 7 | 7 | 124 —127 | .. | 5 10 3 |
| Do. 3½ % Pref. Stock .. .. | Do. | 3½ | 3½ | 75— 77 | .. | 4 10 11 |
| Do. 4 % Mort. Deb. .. .. | Do. | 4 | 4 | 94 — 96 | .. | 4 8 4 |
| Eastern Extension .. .. | 10 | 7 | 7 | 12 — 12½ | .. | 5 12 0 |
| Do. 4 % Deb. .. .. .. | Stock | 4 | 4 | 94 — 96 | .. | 4 3 4 |
| Globe Telegraph and Trust .. | 10 | 6 | 6† | 10⅜ — 11¼ xd | .. | 5 7 10 |
| Do. 6 % Pref. .. .. .. | 10 | 6 | 6 | 11⅜ — 12½ xd | + ¼ | 4 18 0 |
| Great Northern Telegraph .. | 10 | 20 | 5† | 80½ — 82½ | .. | 6 2 8 |
| Indo European Telegraph .. | 25 | 13 | 5† | 57 — 59 | .. | 5 10 2 |
| Mackay Companies Common .. | $100 | 5 | 5 | 79 — 83 | +1 | 6 0 6 |
| Do. 4 % Cum. Pref. .. .. | $100 | 4 | 4 | 64 — 68 | .. | 5 17 8 |
| Marconi's Wireless Telegraph .. | 1 | 20 | 10† | 8 7/16 — 8 9/16 | + 1/16 | 5 12 4 |
| Do. 7 % Cum. Partic. Pref. .. | 1 | 17 | .. | 2⅜ — 2½ | + 1/16 | 5 18 1 |
| Monte Video Telephone, Ord. .. | 1 | 6 | 6 | ⅞ — 1 | .. | 6 0 |
| Do. 5 % Pref. .. .. .. | 1 | 5 | 5 | 1 1/16 — 1 3/16 | .. | 6 8 1 |
| New York Telep., 4½ % Gen. Bnds. | 100 | 4½ | 4½ | 97½ — 98½ | — ½ | 4 11 |
| Oriental Telep. and Elec. .. | 1 | 10 | 10† | 1⅞ — 2 | .. | 5 0 |
| Do. 6 % Cum. Pref. .. .. | 1 | 6 | 6 | 1 1/16 — 1 1/8 | .. | 5 1 1 |
| Do. 4 % Red. Deb. .. .. | Stock | 4 | 4 | 86 — 88 | .. | 4 10 11 |
| Pacific and European Tel., 4 % Guar. Debs. | Do. | 4 | 4 | 97 — 99 | .. | 4 1 |
| Reuter's .. .. .. .. | 10 | 10 | 10† | 8½ — 9½ | .. | 10 16 |
| Submarine Cables Trust .. .. | Cert. | 6 | 6 | 122½ —125½ | .. | 4 15 |
| Telephone Co. of Egypt, 4½ % Deb. Red. | Stock | 4½ | 4½ | 95 — 97 | .. | 4 12 1 |
| United River Plate Telephone | 5 | 8 | 6† | 6⅜ — 6⅞ | + ⅛ | 5 16 5 |
| Do. 5 % Cum. Pref. .. .. | 5 | 5 | 5 | 5 — 5⅜ | .. | 4 11 0 |
| West Coast of America .. .. | 2½ | 2½ | .. | 1 3/16 — 1 1/8 | .. | 4 8 |
| Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel. | 100 | 4 | 4 | 94 — 97 | .. | 4 2 6 |
| West India and Panama Teleg. | 10 | 1½ | 1½ | 2 1/16 — 2 1/8 | .. | 4 12 7 |
| Do. 6 % Cum. 1st Pref. .. | 10 | 6 | 6 | 9½ — 10¼ | .. | 5 17 1 |
| Do. 6 % Cum. 2nd Pref. .. | 10 | 6 | 6 | 9 — 9⅝ | .. | 6 6 4 |
| Do. 5 % Debs. .. .. .. .. | 100 | 5 | 5 | 98 —100 | .. | 5 0 0 |
| Western Telegraph, Ltd. .. | 10 | 7† | 7 | 15⅜ — 15¾ | .. | 5 5 8 |
| Do. 4 % Debs. .. .. .. | Stock | 4 | 4 | 93 — 95 | —1 | 4 4 8 |
| Western Union 4½ % Fdg. Bonds | $10.0 | 4½ | 4½ | 92 — 95 | .. | 4 14 9 |

* Unless otherwise stated, all shares are fully paid. Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

*Continued on next page.*

# SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

| NAME. | Stock or Share. | Dividends for 1912. | Dividends for 1913. | Closing Quotations Dec. 16th. | Rise + or Fall — | Present Yield p.c. |
|---|---|---|---|---|---|---|
| | * | | | | | £ s. d. |
| Bath Trams, Pref. Ord. | 1 | Nil | .. | Nil | .. | Nil |
| Do. 5 % Pref. | 1 | 5 | 5 | | .. | 6 8 0 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 70 — 75 | .. | 6 0 0 |
| Brit. Elec. Trac., 6 % Pref. | 100 | .. | .. | 10 — 12 | .. | .. |
| Do. Do. Deferred | 100 | .. | .. | 4 — 5½ | .. | .. |
| Do. Do. 6 % Cum. Pr'f. | 100 | 6 | 6 | 84 — 87 xd | .. | 6 18 0 |
| Do. 7 % Non-Cum. Pr'f. | 100 | 8 | .. | 52 — 55 | .. | 5 9 1 |
| Do. 5 % Perp. Deb. | 100 | 5 | 5 | 92 — 95 | .. | 5 5 5 |
| Do. 4½ % 2nd Deb. | 100 | 4½ | 4½ | 77 — 80 | .. | 5 12 6 |
| Central London Railway, Ord. | 100 | 3 | 3 | 61 — 66 | .. | 4 11 0 |
| Do. Gtd. Assented | 100 | .. | 4 | 82 — 84 | +1 | 4 15 3 |
| Do. Pref. | 100 | 4 | 4 | 70 — 75 | .. | 5 6 8 |
| Do. Gtd. Assented | 100 | .. | 4 | 82 — 84 | +1 | 4 15 3 |
| Do. Def. | 100 | 2 | .. | 60 — 65 | .. | 3 1 7 |
| Do. Gtd. Assented | 100 | .. | 4 | 78 — 80 | +1 | 5 0 0 |
| Do. 4 % Deb. | 100 | 4 | 4 | 97 — 99 | .. | 4 0 10 |
| City & S. London, 5% Pref., 1891 | 100 | 5 | 5 | 96 — 98 | .. | 5 2 0 |
| Do. Do. 1896 | 100 | 5 | 5 | 96 — 98 | .. | 5 2 0 |
| Do. Do. 1901 | 100 | 5 | 5 | 95 — 97 | .. | 5 3 1 |
| Do. Do. 1903 | 100 | 5 | 5 | 94 — 96 | .. | 5 4 2 |
| Do. 4 % Deb. | 100 | 4 | 4 | 89 — 91 | .. | 4 8 0 |
| Hastings Trams, 6 % Pref. | 1 | 6 | 6† | ⅜ — ⅝ | .. | 8 0 0 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 66 — 71 | .. | 6 6 9 |
| Isle of Thanet Trams, 5 % Pref. | 5 | 2½ | 3 | 2 — 2¼ xd | .. | 6 13 4 |
| Do. 4 % Deb. | 100 | 4 | 4 | 73 — 78 | .. | 5 2 7 |
| Lancashire United, 5 % Deb. | 100 | 5 | 5 | 77 — 81 | .. | 6 3 5 |
| London and Suburban, Ord. | 1 | .. | .. | 3/16 — 5/16 | .. | .. |
| Do. Do. 5 % Cum. Pref. | 1 | .. | 5† | 2/- — 2/6 | .. | .. |
| Do. Do. 4½ % 1st Deb. | 100 | 4½ | 4½ | 74 — 79 | .. | 5 14 0 |
| London Elec. Railways, 4 % Deb. | 100 | 4 | 4 | 90 — 92 | .. | 4 7 0 |
| London United Trams, 4 % Deb. | 100 | 4 | 4 | 59 — 63 | .. | 6 7 0 |
| Metropolitan Railway Consol. | 100 | 1⅝ | 1½† | 43¼ — 43⅝ | .. | 3 14 3 |
| Do. Surplus Lands | 100 | 2½ | 2½† | 58 — 60 | .. | 4 11 8 |
| Do. 3½ % Deb. | 100 | 3½ | 3½ | 83 — 85 | .. | 4 2 4 |
| Do. 3½ % Pref. | 100 | 3½ | 3½ | 78 — 80 | .. | 4 7 6 |
| Do. 3½ % Con. Pref. | 100 | 3½ | 3½ | 75 — 77 | .. | 4 11 0 |
| Metropolitan District Ord. | 100 | Nil | .. | 30 — 30½ | — ¾ | Nil |
| Do. 6 % Deb. | 100 | 6 | 6 | 136 —139 | .. | 4 6 4 |
| Do. 4 % Deb. | 100 | 4 | 4 | 92 — 94 | .. | 4 5 1 |
| Do. 4 % Prior Lien | 100 | 4 | 4 | 93 — 95 | .. | 4 4 3 |
| Do. 4½ % First Pref. | 100 | 4½ | 4½ | 81 — 83 | .. | 5 8 5 |
| Do. 3½ % Gtd. | 100 | 3½ | 3½ | 74 — 76 | .. | 4 12 1 |
| Metro. Elec. Trams, 4½ % Deb. | 100 | 4½ | 4½ | 82 — 86 | .. | 5 4 8 |
| Do. 5 % Deb. | 100 | 5 | 5 | 86 — 89 | .. | 5 12 0 |
| Potteries, Ord. | 1 | 3½ | .. | 5/16 — 7/16 | .. | .. |
| Do. 5 % Pref. | 1 | 5 | 5 | 13/16 — 15/16 | .. | 7 5 6 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 84 — 87 | .. | 5 3 6 |
| South Metro. Trams, 6 % Pref. | 1 | 6 | 6† | ⅜ — ½ | .. | 8 0 0 |
| Do. 4 % Deb. | 100 | 4 | 4 | 68 — 72 | .. | 5 11 1 |
| Underground Elec. Railways | 10 | .. | .. | 3⅜ — 3⅝ | — ⅛ | Nil |
| Do. "A" | 1/- | .. | .. | 1/32 — 3/32 | — 1/32 | Nil |
| Do. 6 % First Cum. Inc. Deb. | 100 | 6 | 6 | 111 —113 | .. | 5 6 2 |
| Do. 4½ % Bonds | 100 | 4½ | 4½ | 99 —101 | .. | 4 9 1 |
| Do. 6 % Income | 100 | 6 | 6 | 88½ — 89½ | — ½ | 6 14 1 |
| Yorkshire (West Riding), Ord. | 5 | Nil | .. | ¼ — ⅜ | .. | Nil |
| Do. 6 % Pref. | 5 | 3 | 4† | 8½ — 4 | .. | 5 0 0 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 81 — 86 | .. | 5 4 8 |

## ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

| | | | | | | |
|---|---|---|---|---|---|---|
| Anglo-Arg. Trams, 1st Pref. | 5 | 5⅛ | 5⅛ | 4⅜ — 4⅞ | +1/16 | 5 17 4 |
| Do. 2nd Pref. | 5 | 5⅛ | 5⅛ | 4 1/16 — 4 3/16 | .. | 6 3 11 |
| Do. 4 % Deb. | 100 | 4 | 4 | 90 — 92 | .. | 4 7 5 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 97⅛ — 99½ | .. | 4 7 0 |
| Do. 5 % Deb. | 100 | 5 | 5 | 97 —100 | + ½ | 5 1 0 |
| Auckland Trams, 5 % Deb. | 100 | 5 | 5 | 101½ — 103½ | .. | 4 16 7 |
| Bombay Elec. S. & Trams, Pref. | 10 | 6 | 6 | 10½ — 11½ | .. | 5 4 4 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 94 — 96 | .. | 4 13 9 |
| Do. 5 % 2nd Deb. | 100 | 5 | 5 | 97 —100 | .. | 5 0 0 |
| Brazilian Traction, Light and Power | $100 | 6 | 6† | 86½ — 88½ | —1½ | 6 15 7 |
| Brisbane Trams Invt., Ord. | 5 | 8 | 8 | 7¼ — 7⅝ | .. | 5 3 3 |
| Do. 5 % Pref. | 5 | 5 | 5 | 4⅞ — 5⅛ | .. | 4 13 0 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 98 —101 | .. | 4 9 1 |
| B. Columbia Elec. Rly., Def. | 100 | 8 | 8† | 111 —115 | —3 | 6 19 2 |
| Do. Pref. Ord. | 100 | 6 | 6 | 102 —106 | —1 | 5 13 2 |
| Do. 5 % Pref. | 100 | 5 | 5 | 102 —105 | .. | 4 15 3 |
| Do. 4½ % 1st Mort. Deb. | 40 | 4½ | 4½ | 98 —101 | .. | 4 9 1 |
| Do. 4½ % Vancouver Deb. | 100 | 4½ | 4½ | 100 —104 | .. | 4 6 7 |
| Do. 4½ % Con. Deb. | 100 | 4½ | 4½ | 92 — 95 | .. | 4 9 6 |
| Calcutta Trams, Ord. | 5 | 7⅛ | 5† | 5⅞ — 6⅜ | .. | 5 17 8 |
| Do. 5 % Pref. | 5 | 5 | 5 | 4 13/16 — 5 3/16 | .. | 4 16 5 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 96 — 99 | .. | 4 11 0 |
| Cape Electric Trams | 1 | 5 | 5 | 3½ — 3⅝ | .. | 6 19 0 |
| City Buenos Aires Trams (1904) | 5 | 5† | 5 | 5¼ — 5⅜ | .. | 4 10 11 |
| Do. 4 % Deb. | 100 | 4 | 4 | 92 — 97 | .. | 4 2 6 |
| Colombo Elec. Tr. & Lt., 5 % Deb. | 100 | 5 | 5 | 88 — 92 | .. | 5 8 8 |
| Havana Elec. Rly., 5 % Bonds | $1000 | 5 | 5 | 94½ — 98½ | .. | 5 1 6 |
| Kalgoorlie Elec. Trams | 1 | Nil | .. | 0 — 1/16 | .. | N |
| Do. 5% A Deb. | 100 | 5 | 5 | 85 — 90 xd | .. | 5 11 1 |
| Do. 6% B Deb. | 100 | 3 | .. | 10 — 20 | .. | .. |
| La Plata Elec. Trams, Ord. | 1 | .. | .. | ⅜ — ½ | .. | .. |
| Do. Pref. | 1 | 4½d. | 6 | 1 — 1 | .. | 6 0 0 |
| Lisbon Elec. Trams, Ord. | 1 | 6 | 6† | 1⅛ — 1⅜ | .. | 4 7 8 |
| Do. 6 % Pref. | 1 | 6 | 6 | 1⅛ — 1 1/16 | .. | 5 1 0 |
| Do. 5 % Deb. | 100 | 5 | 5 | 91 — 96 | .. | 5 4 2 |
| Madras Elec. Tr., 6% Cum. Pref. | 5 | 6 | 6 | 4¾ — 5¼ | .. | 5 14 3 |
| " Elec. Tr. (1904), Deb. | 100 | 5 | 5 | 101 —103 | .. | 4 17 1 |
| Manaos Trams & Lt., 1st Deb. | 100 | 5 | 5 | 84 — 86 | —1 | 5 16 3 |
| Manila Elec. R. and Ltg., Bonds | $1000 | 5 | 5 | 96½ — 98½ | .. | 5 1 6 |
| Mexico Trams Com | $100 | 7 | 7 | 74 — 76 | —4½ | 9 4 2 |
| Do. Gen. Con. 5 % Bonds | .. | 5 | 5 | 80 — 85 | —1 | 5 17 8 |
| Do. 6 % Bonds | 100 | 6 | 6 | 81 — 83 | —1½ | 7 4 7 |
| Para Elec. Rlys. & Lt., Ord. | 5 | 10 | 10† | 5⅞ — 6⅛ | .. | 8 0 0 |
| Do. 6 % Pref. | 5 | 6 | 6 | 4¾ — 5⅛ | .. | 5 17 1 |
| Do. 5 % 1st Deb. | 100 | 5 | 5 | 94½ — 96½ xd | .. | 5 3 8 |
| Perth (W.A.) Elec. Tr., Ord. | 1 | 5⅛ | .. | 1⅛ — 1⅜ | .. | 4 0 0 |
| Rangoon El. Tr. & Sup., Pref. | 5 | 6 | 6 | 5⅛ — 5⅜ | .. | 5 6 8 |
| Do. 4½ % 1st Deb. | 100 | 4½ | 4½ | 96½ — 98½ | — ½ | 4 11 5 |
| Rio de Janeiro Trams, 1st Mort. 5 % Bonds | .. | 5 | 5 | 100⅜ — 102½ | + ½ | 4 17 6 |
| Do. 5 % Mort. Bonds | 100 | 5 | 5 | 90 — 92 | + ½ | 5 8 9 |
| Sao Paulo Tram., Lt. and P. 5 % 1st Deb. | $500 | 5 | 5 | 100 —103 | +1 | 4 17 0 |
| Singapore Trams, 5 % Deb. | 100 | 5 | 5 | 86 — 90 | .. | 5 11 1 |
| Southern El. Tr. B.A., 5 % Deb. | 100 | 5 | 5 | 93 — 95 | .. | 5 5 8 |
| Un. Elec. Trams Monte Video | 5 | 7 | 7 | 4⅜ — 5⅛ xd | .. | 6 16 7 |
| Do. 6 % Pref. | 5 | 6 | 6 | 4¾ — 5½ xd | + ⅛ | 5 14 8 |
| Do. 5 % 1st Deb. | 100 | 5 | 5 | 93½ — 96⅞ | .. | 5 3 8 |
| Winnipeg Elec. Rly., 4½ % Deb. | 100 | 4½ | 4½ | 95 — 97 | .. | 4 12 9 |

## MANUFACTURING COMPANIES.

| | | | | | | |
|---|---|---|---|---|---|---|
| Aron, Ord. | 1 | 7 | .. | 3/16 — 1/4 | .. | 8 12 4 |
| Do. 6 % Pref. | 1 | 6 | 6 | 3/16 — 1/4 xd | .. | 8 0 0 |
| Babcock & Wilcox | 1 | 16 | 14† | 2 1/16 — 2 1/8 | .. | 5 8 11 |
| Do. Pref. | 1 | 6 | 6 | 1 5/16 — 1 7/16 | .. | 4 3 6 |
| British Aluminium, Ord. | 1 | .. | .. | 1 — 1⅛ | .. | .. |
| Do. 6 % Cum. Pref. | 1 | 6 | 6 | 3/4 — 15/16 | .. | 6 12 6 |
| Do. 5 % Prior Liens Debs. | 100 | 5 | 5 | 93½ — 96½ | + ½ | 5 3 8 |
| Do. Deb. Stk. | 100 | 5 | 5 | 85 — 87 | .. | 5 15 0 |
| B.I. & Helsby Cables | 5 | 10 | 8† | 7⅜ — 8¼ | .. | 6 1 3 |
| Do. Pref. | 5 | 6 | 6 | 5¾ — 6¼ | .. | 4 16 0 |
| Do. Deb. | 100 | 4½ | 4½ | 100 —103 | .. | 4 7 5 |
| British Thomson-Houston, Deb. | 100 | 4½ | 4½ | 92 — 95 | .. | 4 14 9 |
| British Westinghouse, Pref. | 3 | Nil | .. | 1 1/16 — 1 1/8 | —1/16 | Nil |
| Do. Deb. | 100 | 4 | 4 | 66 — 69 | .. | 5 15 11 |
| Do. 6 % Prior Lien | 100 | 6 | 6 | 100 —103 | .. | 5 16 6 |
| Browett, Lindley, Ord. | 1 | .. | .. | 2/- — 3/- | .. | Nil |
| Do. Pref. | 1 | .. | .. | 8/- — 8/6 | .. | Nil |
| Brush, 7 % Pref. | 2 | Nil | .. | 0 — ¼ | .. | Nil |
| Do. 5 % Prior Lien Deb. | 100 | 5 | 5 | 70½ — 75½ | .. | 6 12 5 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 85½ — 40½ | .. | 11 2 2 |
| Do. 4½ % Second Deb. | 100 | 4½ | 4½ | 23 — 27 | .. | 16 13 4 |
| Callender's Cable | 5 | 15 | 5† | 10½ — 11¼ | .. | 6 13 4 |
| Do. Pref. | 5 | 5 | 5 | 4⅝ — 5⅛ | .. | 4 17 7 |
| Do. Deb. | 100 | 4½ | 4½ | 96 — 99 | .. | 4 10 6 |
| Castner-Kellner | 1 | 20 | 22½ | 3 1/16 — 3 1/8 xd | .. | 5 18 7 |
| Do. Deb. | 100 | 4½ | 4½ | 104 —107 | +2 | 4 4 1 |
| Crompton & Co., Deb. | 100 | 5 | 5 | 68 — 73 | +1 | 6 17 0 |
| Dick, Kerr | 1 | Nil | .. | 1/16 — 1/8 | .. | .. |
| Do. Pref. | 1 | 6 | 6 | 13/16 — 7/8 | .. | 7 2 2 |
| Edison & Swan, A, £2 paid | 5 | Nil | .. | 0 — ⅛ | .. | Nil |
| Do. fully paid | 5 | Nil | .. | 1 — 1⅛ | .. | Nil |
| Do. 4 % Deb. | 100 | 4 | 4 | 58 — 62 | .. | 6 9 1 |
| Do. 5 % Second Deb. | 100 | 5 | 5 | 63 — 68 | .. | 7 7 1 |
| Electric Construction | 1 | 5 | .. | 1/16 — 1 1/16 | .. | 7 5 6 |
| Do. Pref. | 1 | 7 | 7 | 1 1/16 — 1 1/8 | .. | 6 11 9 |
| Greenwood & Batley, Pref. | 10 | 7 | 7 | 6½ — 7½ | .. | 9 13 2 |
| Do. Deb. | 100 | 5 | 5 | 92 — 94 | .. | 5 6 5 |
| General Electric, 6 % Pref. | 10 | 6 | 6 | 9⅝ — 10⅜ | .. | 5 15 8 |
| Do. Deb. | 100 | 4 | 4 | 88 — 93 | .. | 4 6 0 |
| Henley's, Ord. | 5 | 15 | 10† | 12⅜ — 13½ | .. | 5 11 1 |
| Do. Pref. | 5 | 4½ | 4½ | 4 13/16 — 5 1/16 | .. | 4 8 11 |
| Do. Deb. | 100 | 4½ | 4½ | 100 —102 | .. | 4 8 3 |
| India-Rubber, G. & T. | 10 | 7½ | 5 | 12 — 13 | — ½ | 5 15 5 |
| Do. Pref. | 10 | 5 | 5 | 9½ — 10 | .. | 5 0 0 |
| Telegraph Construction | 12 | 20 | 5† | 37 — 39 | .. | 6 3 1 |
| Do. Deb. | 100 | 4 | 4 | 96 — 98 | .. | 4 1 8 |
| Willans & Robinson, 4 % 1st Mort. Deb. | 100 | 4 | 4 | 59 — 63 | +4 | 6 7 0 |
| Do. B 4 % Cum. Pref. | 100 | .. | .. | 35 — 40 | +7½ | .. |

* Unless otherwise stated all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 2nd, 1913.

## THE PASSIVE STATE OF METALS.

At a recent meeting of the Faraday Society a general discussion was held on the subject of the "Passivity of Metals." The subject was introduced by Mr. S. G. Senter, who reviewed the various theories that have been put forward to explain the mysterious phenomenon of the passive state from the time of Faraday onwards, and a group of seven papers was then read and discussed, in which every aspect of the subject received careful and critical consideration. Dr. G. Grube, representing the very active physico-chemical school of Dresden, read the first paper, and other papers read or communicated, were by Dr. H. S. Allen, Dr. D. Reichinstein (Zurich), Prof. M. Le Blanc (Leipzig), Prof. G. Schmidt, and Dr. W. Rathert (Münster), Prof. Günther Schulze, of the Reichsanstalt, and Prof. E. P. Schoch (Texas). The discussion brought forth an excellent little supplementary paper from Dr. E. K. Rideal, one of our youngest recruits in the field of electrochemical research. The complexity of the subject, complex in spite of the apparent simplicity of its basic phenomena, makes it impossible to do justice to the discussion in the small amount of space at our disposal, and we must content ourselves with the briefest possible outline of the present state of our knowledge as put forward at the Faraday Society meeting. For this no apology is needed, even in a purely electrical journal, for the mechanism of the passive state, whatever it be, has the closest possible relation to the mechanism of electrolysis generally, and it is no exaggeration to say that a complete understanding of the one will throw a flood of light on the still more intricate and perplexing problems that cluster round the other. To the practical man even more, for it will lead him to understand what corrosion is, what determines it, and how it can be prevented; for what is a non-corrodible steel or ferro-alloy, for example, but a metal in a permanent state of passivity?

The simplest and best known example of passivity, and the one that was first discovered, namely by Keir, in 1790, is the fact that ordinary iron which is vigorously attacked by dilute nitric acid is not only unacted upon if immersed in strong nitric acid, but is subsequently rendered immune to the action even of the dilute acid. The first theories put forward, and still largely held, were that the "passivity," as Schönbein called it, was due to the protective action of a close, invisible film of oxide, or as Faraday with his usual perspicuity was careful to add, "that the superficial particles of the metal are in such relation to the oxygen of the electrolyte as to be equivalent to an oxidation." The meaning and suggestiveness of this pregnant phrase do not appear to have been properly appreciated until Hittorf began, in his experiments on passive chromium, to lay stress on the electrochemical aspects of the problem. Stated in electrochemical terms, passivity may be defined as a state of anodic polarisation which shifts the metal up the electrochemical scale in the direction of the so-called "noble" metals. In other words, a higher potential is necessary to drive a given current through a metallic anode in the passive state than when it is in the active state. Stating it thus one is easily led to the Le Blanc standpoint that passivity is not an absolute but a *quantitative effect*, namely the *retardation* of some chemical or electrochemical reaction. The experimental work of Professor Foerster and his pupils at Dresden, put forward by Dr. Grube, throws much light on and strengthens greatly the value of this conception, for they have shown that the kathodic deposition of the metals of the iron group, in itself a slow process, was further considerably retarded by the simultaneous deposition of small quantities of zinc or hydrogen. What happens at the kathode gives a key to what may happen at the anode, lending support to the view that the retardation of electrolytic action at an anode when in the passive state is due to the formation in it of alloys of oxygen, which it is imagined have a lower solution pressure than the pure metal. Such retardation of anodic discharge has been observed when halogen salts are electrolysed with platinum anodes under conditions that give rise to the deposition of oxygen; also there is evidence that the formation of alloys of platinum and oxygen brings about the retardation.

Interesting support was given to the oxygen-alloy, or oxygen-film theory of passivity by Dr. H. S. Allen, whose experiments in photo-electric activity (the dissipation of a negative charge by means of light) have shown that iron which was chemically active, was active in the photo-electric sense, while passive iron shows greatly reduced photo-electric activity. Now the existence of photo-electric fatigue, points unmistakably to the presence of a film of gas on the surface of the metal, and the connection between the two sets of phenomena may therefore be taken as affording weighty evidence in favour of the oxygen theory.

The old oxide-film theory, which supposes that the passive metal is merely mechanically protected from the action of the acid, or more generally, the electrolyte, finds few supporters nowadays, as some of the properties of passivity, such as its destruction by heat, and the fact that no alteration in reflecting power has been detected where an active metal is rendered passive, seem inexplicable on the oxide-film hypothesis. Where an oxide-film does form it is generally held to be a result, rather than the cause of passivity.

An ingenious theory that has been suggested as a rival to those already considered is that of Le Blanc himself, explained with exemplary lucidity in a paper he sent in to the meeting. According to the current conception of electrode action associated with the name of Nernst, the primary reaction taking place when a metal is plunged into an electrolyte is the dissolution—to a limited and very minute extent if the metal is pure—of the electrode to form metallic ions in solution. These ions, however, are not free, but immediately unite with the solvent to form hydrates. If the reversible reaction, ion+water—ion-hydrate be a slow one, the action at the electrode will be retarded, and it is this retardation which gives rise to anodic polarisation or passivity. The weakness of this theory is that we have no independent evidence that ionic hydration is so slow a process as the theory demands.

An alternative theory of Le Blanc is based on the view that the primary electrolytic action at the anode is not the formation of metallic ions, but a discharge on to the electrode of negative ions (anions) from the solution, much as Grotthus imagined long years ago. This secondary chemical discharge is instantaneous, but the effect, namely the interaction between the discharged radicle and the metal, might be retarded under certain conditions, and if so this retardation would be the explanation of passivity. Much the same theory was favoured by Professor Schoch, who in his communication, pictured the retardation somewhat as follows. When the current density at the anode exceeds a certain limit its surface will be covered with discharged ions, and thus access of further anions to the surface will be impeded. From a study of the structure of aluminium anode films, as put forward by Prof. Günther Schulze, Schoch supposes that the complex ions which are prevented from reaching the surface of the anode will be dissociated and oxygen ions formed from them. These are discharged upon the anode and either an oxide or an oxygen film then forms upon its surface.

An altogether different conception of passivity was that put forward by Dr. G. C. Schmidt, whose theory is that the passive metals are normally so, only becoming active in the presence of some catalyst, of which the most important known is hydrogen, since it is dissolved readily and in large amounts by metals. Experiments described were claimed to show that metals may remain passive in the absence of oxygen, such as polishing in an atmosphere of hydrogen and nitrogen, and determining their potentials at once, although these experiments can hardly be regarded as conclusive, in view of the known enormous tenacity with which air clings to ordinary metal sheets and the well-nigh impossibility of removing the gaseous films. Nor can the further ingenious experiments made by Dr. Schmidt, in which he has shown that hydrogen ions diffusing through passive iron and chromium activates these metals, be considered any more conclusive, for the original passivity might still have been due to the presence of oxygen or oxide films.

On the whole then it must be said that one result of the interchange of views that took place at the meeting was decidedly to strengthen the position of those who hold the oxygen film or oxygen alloy theory of passivity, and although in some cases actual oxidation takes place this is more probably a result than a cause of the initial passivation due to the presence and action of oxygen.

Between the afternoon and evening sittings—for the discussion began at 5 p.m. and did not terminate until after 10 p.m.—specimens of passive irons and of non-corrodible steels and other ferro-alloys were exhibited by Sir Robert Hadfield (described by Mr. S. A. Main), Dr. J. Newton Friend, Mr. Robert Lennox, and Mr. John Evans. Mr. Lennox's very interesting alloy is called Tantiron, and is a hard, close-grained, silvery-white alloy, melting at about 1,400°C. It neither rusts nor oxidises, and it is not attacked by ordinary corrosives to any marked extent. Some of the castings shown were portions of nitric acid plants. Mr. Evans showed an autocleve that had been used for distilling strong acetic acid, made of a French alloy called "Métilline," the invention of M. Jouve, of Paris. The composition of neither of these alloys was stated, but they are believed to consist largely, if not entirely, of ferro-silicon. Among the most interesting of Sir Robert Hadfield's specimens were some chippings from the famous Iron Pillar at Delhi, erected probably some 1,600 years ago, and which during this long period has shown extraordinary resistance to atmospheric corrosion. It is made of almost pure wrought iron.

## APPLICATION OF ELECTRICITY TO AGRICULTURE AND LIFE.

The commercial possibilities of plant and chicken electroculture, and of the electro-destruction of blight and bacteria by high-frequency electric current, formed the subject of a paper read by Mr. T. Thorne Baker before the Royal Society of Arts on December 10th. The author referred to Lemstrom's classic researches and reviewed the methods employed and the results obtained by the Lodge-Newman system, with which much work has already been done in this country. The cost of a 25-30 acre equipment complete is £200, but £300 covers the total cost of a 60-acre installation. The U.S.A. and the Egyptian Department of Agriculture are at

present engaged in experiments with the Lodge-Newman system. Results obtained during the hot dry summer of 1911 led the author to believe that high-frequency alternating current would, in some cases, give better results than purely positive discharges from overhead wires.

The author finds that the upper portion of a living plant is negatively and the lower part positively charged, the plant generating in fact a few millivolts e.m.f. It is suggested that the hairs on the leaves and stem of the negatively charged part of the plant collect positive atmospheric electricity—the actual amount collected being very small. The mistake most frequently made in artificial electro-culture is that of employing too powerful a current. Every plant and organism demands carefully selected and graduated treatment.

The effluve discharge from a resonator coil appears to have valuable germicidal properties. If gooseberry bushes infected with red American blight are sprayed with a soluble sulphide and then treated with a high-frequency effluve, nascent sulphur is produced and this kills the blight. Cheese mites can readily be killed by the discharge from an Oudin resonator, but the black fungus which attacks Norwegian dried cod only suffers temporary inhibition, and then grows with every evidence of stimulation after treatment by an effluve discharge.

Up to one or two milligrammes of radium is contained per ton in the residual waste thrown out by radium works, and this material mixed with many times its own weight of ordinary soil is said to accelerate and increase materially plant growth. The recently evolved process for the preparation of radium from carnotite should provide an ample supply of "radium refuse," and the author estimates that the cost of treating land suitably with radio-active material should not exceed 10s. to 15s. per acre. The treatment would retain its efficacy for a number of years. Too great radio-activity is harmful.

In the author's opinion, the most profitable application of electricity to the farm is in rearing chickens. A coil yielding a 1-inch spark is sufficient for the simultaneous "electro-culture" of 1,000 chickens. On Mr. R. Meech's poultry farm at Poole, a chicken house consisting of six flats, each large enough to accommodate 75 chickens, was electrified by a helix of heavily insulated wire wound round it in turns about six inches apart. High-frequency current was applied for ten minutes in each hour of the day. Out of a total of 400, only six chickens died (1.5 per cent mortality) and the birds were ready for market in five weeks as against three months. A chicken grown under the influence of electricity will grow of normal weight with only two-thirds the normal amount of food; or with the full amount of food, it will grow from 33 to 100 per cent. heavier than normal. It is said that during treatment the birds are so highly charged that sparks can be drawn from their beaks and a distinct shock felt on touching them. Experiments are at present in progress on a batch of 4,000 birds, and on several complete generations (egg to egg). The results so far obtained appear to be extraordinarily successful, and we await further reports with keen interest.

In opening the *Discussion*, the chairman (Mr. Campbell Swinton) emphasised the importance of this field of research, and pointed out the great difficulty encountered in distinguishing electrical from purely mechanical, physical, or chemical effects. Mr. Newman referred to the practical difficulties encountered in applying electric stimuli to small test areas and the difficulty of establishing a reliable "control." High-tension continuous-current discharges had now been used for over eight years, and good results had been obtained fairly consistently. In a few years' time, Prof. Priestley would be able to tabulate the results of his wide researches, and the action, effects and commercial value of electro-culture should then be definitely established. Other speakers referred to the difficulty of interesting agriculturists in scientific apparatus and measurements, and emphasised the severely commercial basis on which electro-culture would always be judged. It was mentioned that four or five years ago President Diaz's son erected a hydro-electrical plant in Mexico, and obtained from 17 per cent. to 70 per cent. increase in yield of various crops by the application of electro-culture over a wide area.

## THE CHARACTERISTICS OF INSULATION RESISTANCE.

On Tuesday, December 2nd, the paper read by Mr. S. Evershed was discussed by the Manchester Local Section of the Institution of Electrical Engineers.

Mr. Welbourn referred to the curve for cotton showing the relationship between megohms and potential difference, of which the lower part was under investigation; this matter had attracted a good deal of his attention, and he suggested that the curve began to turn owing to the dispersion of moisture and subsequent rise in current density in the leakage paths causing charring, which ultimately caused breakdown. The common practice of measuring the insulation of absorbent materials after one minute's electrification was only to be regarded as a qualitative test, because of the limiting factors of time and space. He did not see what test could be substituted for the flash test in the case of an absorbent insulator which was required to withstand the pressure rises to which electric circuits were subjected.

Mr. A. P. M. Fleming said he presumed that the measurements had been made at a constant temperature, because one often found engineers making insulation resistance measurements on machines quite irrespective of temperature, unaware of the fact that a few degrees difference in temperature might alter the insulation resistance one hundred-fold. Some ten years ago, buyers of electrical machines measured everything by the number of megohms, and makers were called upon to show 20 or 200 megohms according to the ideas of the buyers. To do this the makers would dry the machines by heating until the insulation resistance was good enough and sometimes until all the nature had been taken out of the insulating material. To-day the counterpart of those machines would undergo no such test, and the insulation, if measured at all, would be found to be probably of the order of a megohm or less according to the size and voltage. A machine under those conditions was likely to run just as safely and have a far greater length of life.

Prof. Miles Walker agreed with a previous speaker that the puncture test was a very useful one. A surprising feature of the tests was the small amount of the total water which actually took part in the conduction. He could not see why the ratio should remain practically constant at about 2; one would expect to find it variable. Why should the capillary tubes used by the author give the same constant as the microscopic capillaries in cotton? If the author could explain why the co-efficient remained constant it would show more than the curves themselves. Curves of the character shown could be explained in a number of different ways. It was known that the conductivity of an electrolyte was due to ionisation, and it was supposed that if water could be obtained sufficiently pure, it would be an insulator. London water was comparatively full of ions, its conductivity being much greater than that of Manchester water, and it was of interest to know whether the blotting pad used in the experiments had been moistened by steam carefully prepared. If the author's theory were true, it would appear that water of lower conductivity would show increased insulation resistance. He felt that it did not depend particularly upon the purity of the water forming the films so much as on the action between the water and the material, setting up some form of ionisation and forming a conducting layer. Hysteresis could only occur when dealing with two elements which constituted energy; megohms and volts did not constitute energy, therefore the author's curve was not a hysteresis curve.

Mr. J. S. Peck asked how long a time elapsed after the voltage was applied before the resistance measurement was taken; he understood from Mr. Welbourn that if a certain voltage was applied to a cable and left on for a time, the resistance gradually dropped. Referring to the cotton curve, he asked whether, after the critical point had been passed and the voltage was maintained at 1,000, the insulation gradually dropped to zero. With regard to the barbaric flash test, it was always advisable to try the apparatus with a Megger or other indicating device in order to be fairly sure that the insulation was good before applying the flash test. If a machine tested out lower than usual with the indicating instrument, means should be adopted to clean or dry out the apparatus before applying the flash test.

Mr. C. J. Beaver said pressure tests consisted of either the application of a very high pressure for a short period (flash test) or a high pressure for a long time. It was not uncommon in the case of a cable that was going to break down, to find that the breakdown would occur within the last five minutes of the pressure run. In such cases the long high-pressure test had an advantage over the flash test. Contrary to the author's assertion, cable makers could get dry paper, and did get it. The great conclusion to be drawn from the author's paper was that absorbent insulators had their limits, as indicated by the curve. When the length of the time joining the first and second parts of the curve could be prolonged the condition was a happy one, as the moisture which got in could be driven out.

Mr. W. Cramp opposed Prof. Walker's remarks on "hysteresis"; the word simply denoted "lag," and had been dragged into connection with energy without any justification whatever. The author's denunciation of the one-minute electrification test might be sufficient to change entirely the tests on cables and machines, but he would like to know of an alternative. Notwithstanding the author's remarks concerning leakage at fittings being everything and leakage in the cable nothing, it remained necessary that cable should be tested in a manner to make sure that no conducting particles were present in the dielectric. The speaker agreed with Prof. Walker regarding the shape of the curves. In capillary tubes the spaces between the dormant masses were filled with vapour of the liquid, and since vapour conducted there was reason to suppose that this was a path for current as well as the films on the sides. If the conductors of a dynamo were enamelled before being otherwise insulated, would it not help to solve the problem which the author put forward? The speaker recently received a motor stipulated not to exceed 75° Fah. rise in temperature. Actually the temperature rise was 94° Fah., and the reason was given that since the motor was intended for use in a

damp place, it had been designed with this temperature rise to counteract the atmospheric conditions.

Mr. CUNLIFFE thought it probable that the constant obtained by the author was due to the presence of water in the insulating medium. Would the same curve be obtained if a solution of a salt such as sodium chloride was used? He had conducted experiments on a tube containing dry sand with an electrode at each end. Plotting resistance against time, a curve was obtained which fell at first and then rose again, in direct opposition to the author's curve. When using moist sand it was also found that the potential gradient curve was straight at first and finally similar to the author's curve owing to the effect of endosmose. The shape of the curve also depended upon the polarity.

The AUTHOR, in reply, said that the current density in the films was so extraordinarily small that $C_2R$ was measured in millionths of a watt in the whole insulator. Samples were purposely selected which did not give large $C_2R$ losses, in fact the heating was never noticeable. All the tests were taken at a constant temperature. No doubt, in the second part of the curve, heating commenced to be a somewhat serious matter. Mr. Welbourn had suggested that ultimately the films got hot and charring took place; this was certainly a possible explanation, but another solution was the formation of brush discharges. The author was not disposed, however, to answer this question definitely before making further experiments. Regarding the time taken in the moisture curve tests, so long as the capacity current was allowed to die away steady readings were obtained. The author did not object to the "one-minute electrification" test; probably as a comparative test it proved what was intended to be proved. The objection to the flash test was that it was a blind test. High-pressure tests were necessary on all electrical apparatus, but it was always necessary to have an indicating instrument in circuit. A Megger testing set was being tested to 3,000 volts; when the pressure reached 1,500 volts a leakage was indicated by the indicating instrument, and had this instrument not been in circuit the Megger would probably have left the factory only to be returned faulty after being in use for a short time. Surface films were very difficult to experiment upon, owing to their instability. A moisture curve was only obtainable when there were drops on the surface of the insulator. It was an extraordinary fact that, notwithstanding that different insulators were used, the curves were practically alike. The results seemed to point to some extraordinary law between endosmose and surface conduction. Regarding the pad experiment, the purest paper obtainable was used, so that it should not contain anything to increase the conductivity of the water. One of the reasons for using London water was that the existence of ions would overpower any effects from the paper itself. Distilled water had been tried, but discarded on this account. Regarding Mr. Beaver's remarks that cable makers did obtain paper entirely free from moisture, another speaker had stated that when moisture was absolutely removed from paper, the paper became very brittle. The author agreed with Mr. Cramp concerning the definition of "hysteresis." In view of the possibility of some of the current passing through the vapour in the bubbles, it was interesting to note that the effect was still produced with as low a potential gradient as one volt per cm. Mr. Cunliffe's experiment with sand was well known as demonstrating the effect of endosmose at the positive electrode. When the water in the sand was uniformly distributed, the potential gradient was uniform, but as the water was driven away the curve changed entirely. This procedure could be carried on until perfect insulation was obtained.

## CO-OPERATIVE CONTROL OF ELECTRIC SUPPLY UNDERTAKINGS.

By R. A. CHATTOCK.

THE recent report of Sir Francis Oppenheimer, Commercial Attaché to His Majesty's Embassy at Berlin, upon "The Supply of Electricity in Germany by the Chief Works in which Private Concerns and Public Bodies are jointly interested," has given food for very serious thought upon this most important subject.

The use of electrical energy for light, power, heating, domestic requirements, and traction by rail, road and tramway, is being extended year by year at an extraordinarily increasing rate even at the present prices per unit. Especially is this the case with power supply for manufacturing purposes, whilst there is evidence of an enormous development in the near future in connection with the electrification of our railways, both suburban and main lines.

The welfare of the whole community depends upon the commercial prosperity of the country; in other words, upon our manufactories.

The life-blood of the manufactories is cheap power, and they are also enormously affected by cheap transit both of goods and workmen.

It therefore behoves all electric supply undertakings to strive for and obtain this one object if they are to justify their existence. Cheap electrical energy is vital to the whole country, and the supply of this should, therefore, never be exploited with the object of earning large profits and paying large dividends.

This economic truth is the real reason underlying the various changes that have taken place during the past 20 years in the methods of controlling electric supply undertakings.

Let us now consider what has been already done in this country, and compare this with what has happened in Germany as described in Sir Francis Oppenheimer's report.

In the early days, electric supply was confined practically to lighting only. Power supply gradually grew, the load factor of the supply was improved, and the cost of production was in consequence reduced, with the result that the price per unit of the current sold was also reduced. This process has gone on until the demand of the large industrial areas has called into being the large power stations and supply systems—some municipal and some company controlled—that are at present dealing with this demand.

In the London area, competition between two or more undertakings in the same area was tried in the early days with the object of cheapening the cost to the consumer. This has not proved more than transiently beneficial, as is shown by the better results that have been obtained by undertakings that are not subjected to competition. It would appear obvious that duplication of stations and mains in any area must have the effect of preventing that reduction in the cost to the consumer which should be the ultimate aim and end of all such undertakings. Competition, however, undoubtedly helped along the general cheapening of the supply at that period.

After the way had been indicated by these early ventures, the various municipal authorities in the country began to recognise the possibilities contained in this new industry; to some of them, unfortunately, the prospect of making large profits, which could be applied to the relief of the rates, was the chief inducement. This consideration has to no small extent interfered with the chief object of all electric supply undertakings, viz., the giving of the cheapest supply possible to the community. Many municipalities, however, have recognised the extreme importance of this point, and are developing their undertakings on sounder lines; they are realising that a cheap and efficient supply of electrical energy is one of the prime necessities of their well-being. On it depends their very existence, for without it the manufacturers will be driven elsewhere, and the workmen, who represent so large a part of their population, will be forced to go with them.

It has recently become the fashion to adversely criticise municipal undertakings, and to assume that power companies are going to cure all the ills to which municipalities are heirs. It seems to me that a general return to company control will, to a certain extent, reproduce the undesirable conditions that characterised the early days of the industry in London. The large municipalities have certainly shown that, in spite of the disabilities under which they work and the restricted areas they supply, they have been capable of developing enormous undertakings, which are giving a supply at a figure comparing favourably with that of the best of the power companies, whose areas are not so restricted.

The phenomenal growth of the larger municipal undertakings, such as Glasgow, Manchester, Birmingham, Liverpool, Leeds, &c., has shown the enormous importance of centralisation as a factor in the cheapening of the cost of production. The formation of the large power companies is undoubtedly due to the realisation of this point.

The smaller municipal undertakings are mostly handicapped by their restricted areas, and by their inability to supply at as low a price per unit as the larger undertakings and

show a balance on the right side. They can never take advantage of the benefits of centralisation, unless it is by co-operation in some form or other. It is true that some of the small undertakings are showing excellent results, but these can generally be traced to local conditions, such as concentration of the supply geographically, or a cheap supply of fuel being available. Co-operation, to be of any real use, must include the thickly populated areas as well as the smaller centres, and the only possible arrangement of this kind at the present time is with the power companies where these are available. There is undoubtedly jealousy between contiguous municipal supply undertakings which does operate against their working together, and which, in the case of a large number of such bodies, would practically prohibit co-operation.

Turning now to the development that has gone on in Germany, Sir Francis Oppenheimer's report makes it clear that the lines are very similar to those that have been observed in this country, and to which I have referred above.

Private company undertakings were the rule at first, and these apparently used their monopolies to the detriment of the consumer. A reaction in favour of municipal control followed, which has also not proved entirely satisfactory, owing to the machinery available for the management of these undertakings being too cumbersome and inelastic.

The outcome has developed into dual control under which the company manages the undertaking, and the municipalities concerned assist in financing it and are represented upon the supervising board.

The advantages claimed for this arrangement are: Company control appears to be more flexible. It is not subject to boundary restrictions, and can include large areas in its operations comprising many municipalities. Centralisation and its beneficial effect upon cheapening the cost of production can be taken full advantage of. Special tariffs can be better negotiated.

The undertaking can be extended more quickly and readily to meet industrial requirements.

Municipal finance can provide the capital required at a cheaper rate of interest.

Small as well as large municipalities can be interested in and can join in the same concern without allowing jealousy of each other to interfere. The procedure as regards opening streets for laying mains, and dealing with other municipal departments such as water, gas, tramways, &c., is made much easier.

This last phase of the industry in Germany is undoubtedly a step in advance of what has been done hitherto, and will help to improve the conditions governing electric supply, chiefly owing to the beneficial effect of centralisation.

It might form a partial solution of the difficulty that is being experienced with the smaller municipal undertakings in this country. I do not, however, consider that it goes nearly far enough. The arrangement certainly eliminates some of the disadvantages both of company controlled and municipal undertakings, but it retains the chief and serious disadvantage of exploiting the supply of electrical energy, with the sole ultimate object of earning profits, whether small or large, for the benefit of the shareholders.

This is laudable enough in a concern that is being run in the interests of a few individuals, but, where the well-being of the whole community depends so vitally upon a cheap supply, and upon husbanding the resources of the fuel supply, the result should never, under any conditions, be subject to such a powerful restriction.

The only alternative that I can see, therefore, is nationalisation of the supply, *i.e.*, control of the whole of the supply by a Government department, in a similar way to the control of the Post Office and of the telephone service. I am aware that the latter is not at the moment a very happy example, but it is only a question of proper organisation to put this service on a satisfactory basis. There is just as much, if not more, justification for this, as there is in the proposal for the State to take over the railways.

Such a course would meet all the disabilities under which the present supply undertakings are working, both in this country and in Germany, whether they are under municipal or company control, or both.

The country could be properly mapped out in areas, the boundaries of which would not be municipal or county, but arranged geographically to suit the industrial requirements of the country as a whole.

Existing undertakings would be purchased by the State, certain of the existing power stations would lend themselves to development, others would be dispensed with for generating purposes, and would form convenient centres for distribution. New power stations would be built conveniently for the two main requirements, *i.e.*, cheap fuel and ample water for condensing purposes. These would be of the largest capacity so as to take the fullest advantage of centralisation.

Overhead distribution could be developed on systematic and proper lines, and full advantage taken of the great economy in the cost of this method.

The scheme would lend itself admirably to supplying energy to the railways in bulk, as it would cover practically the whole of the country, and be on such a scale that there would be no danger in relying upon it for continuity of supply.

There would be no difficulty as regards opening streets and obtaining wayleaves across private property, or through the areas of local authorities.

The capital required would be raised on the best possible terms as regards interest and periods of loans. There would be no necessity for making any profits beyond a suitable sum for reserve and depreciation.

Rates of charge could probably be standardised within limits all over the country.

I am convinced that from an engineering point of view this scheme is the only one that can ensure proper centralisation, real economy, and the elimination of obstructive restrictions. It can be inaugurated now with a very much smaller expenditure than will be the case in, say, 20 years' time. There is no risk attached to it, as the enormous development now going on in all industrial countries indicates, whilst the return on the capital now invested is a proof that it would be self-supporting.

## THE FUTURE OF MUNICIPAL ENTERPRPRISE.

By GEORGE OFFOR.

The existing conditions under which the electrical industry is carried on are by no means perfect, but in what way they can be successfully modified is a problem not very easily solved.

When the Electric Lighting Act of 1882 was passed, the policy of municipal control and the ultimate ownership of the undertakings, was provided for on terms which practically paralysed the embryo industry for many years, and although under the Act of 1888 the alteration in the purchase clause rendered the acquisition of capital possible, the business has always been more or less hampered by the contest between the principles of "municipal" *versus* "private" trading.

It is interesting to refer at this point to a speech by Lord Salisbury, who was Prime Minister at the time, which he delivered at Knightsbridge (see *Times*, May 21st, 1885). He said:—"Mr. Chamberlain has had in his hands a certain industry which at one time seemed promising, viz., that of furnishing electric light to the community. I tell you it is not a large matter, but you can study the action of laws on small matters as well as large. He was not content to allow it free scope to win its way as best it could. He was not content to trust to the results of free energy and exertion, but he thought that he would get ransom. And, therefore, he procured an enactment in Parliament that, after 21 years, any enterprise which these electric light companies set up should be confiscated for the benefit of the municipality under which they acted. What was the result? It shows you how this plan of exacting ransom from property answers. Bankruptcy has followed, I think, every one of those companies; the industries have been absolutely stifled, and an invention which in America is marching with gigantic strides, and contributing largely to the comfort of the population, is here entirely strangled."

I have before me a little pamphlet issued by the Municipal Electric Supply Co., about the year 1900, which sets forth proposals somewhat on the lines of the system referred to by Sir F. Oppenheimer, in his report upon German practice. The pamphlet states that the company is prepared to undertake the supply of electricity to towns on the municipal system, "the main idea being that the statutory powers shall be the property of the Council and the electric supply substantially a municipal undertaking, but that the capital expenditure for making the business successful shall rest upon the company until the Council see fit to take it over."

This suggestion did not take on, and the company ultimately organised a large and successful business in ordinary commercial undertakings, subject to the provisions for enabling the local authorities to become the ultimate owners.

The terms of purchase, under provisional orders, vary considerably, the following being examples of the bargains made with local authorities under agreements within my personal experience :—

1. Fair market terms as a going concern, giving two years' notice of intention to purchase, after 12 years from date of order.

2. Under Sec. 2 of the Electric Lighting Act, 1888, at the end of 42 years.

3. Alternative terms at the option of the local authorities : (*a*) At any time on two years' notice at fair market value as a going concern ; (*b*) on capital expenditure plus one-third.

4. Alternative terms at the option of the local authority, viz. : (*a*) Value as a going concern ; (*b*) a sum equal to 25 years' purchase of the average net profits during five years previous to expiration of the notice to purchase ; (*c*) capital expenditure, plus 25 per cent., if purchased within 14 years, 15 per cent. if after 21 years, and 10 per cent. after 28 years.

5. Under Sec. 2 of 1888 Act, after 1947, on giving six months' notice.

6. Valuation as a going concern within six months after 10½ years from December 31st, 1899, and any subsequent period of two years. After 42 years under Sec. 2 of 1888 Act.

7. Under Sec. 2 of 1888 Act after 1942, and every 10 years thereafter, or as a going concern within six months after July 30th, 1914, and every seven years thereafter, on giving two years' notice.

8. The option of taking over the undertaking at any time on issuing to the company bonds of the local authority sufficient to pay 5 per cent. on the capital properly expended.

In a pamphlet issued by one of the companies with which I was associated some years ago, a proposal was put forward for arrangements with the local authorities on the following terms :—

1. The Parliamentary and legal expenses incurred in procuring the order to be borne by the company.

2. Upon the expiry of two years' notice given at any time after the end of 10 years, the Council shall be entitled to purchase the entire undertaking and goodwill at a value to be fixed by independent valuers.

Any arrangement under which the local authority should have a voice in the management of the business, would, I think, be quite impracticable.

The objection to municipal trading in electricity supply is not only based on the old principle of "every cobbler sticking to his last," but obviously those who do not understand the business and have no capital except what they borrow and pay interest upon, are not justified in speculating in such undertakings at the risk of the ratepayers. To permit such bodies to exercise any control over the management, which requires both commercial and technical proficiency, would be fatal.

I agree with you that "the time is not far distant when the inherent weaknesses of public ownership will lead to agitation for a change." While the option of taking over the companies' undertakings exists, there may be some grounds for argument in support of local authorities assisting in providing capital to enable them to provide sound extensions of the business, but in such a case the objection would still exist that they could not furnish the money without a guarantee of the interest and sinking fund, apart from any question of control over the expenditure, whereas capital raised by the company through its shareholders would only be paid for out of actual profits.

The legitimate business of a local authority is to manage the sanitary affairs of the town, in sewage works, &c., construct and maintain roads and streets, to administer the Building, Factory, and other Acts connected with the local management, all of which duties, and the financial arrangements arising out of them, they can properly undertake, but they should not interfere with ordinary trading, and especially in such a business as the supply of electricity.

In some towns the craze for trading has been carried to the extent of municipal ownership of both the electricity and gas supply, and not without obvious friction between the several Committees who are competing with each other.

Municipal trading in electricity supply has not been generally prosperous, even in many cases where contributions out of supposed profits have been made in relief of rates, which is analogous to a company paying a dividend out of capital. On analysing the accounts of many local authorities, it has been found that either no reserve has been made to cover depreciation or obsolescence of the plant, or else there is an altogether insufficient provision for those contingencies, and it has been argued that the sinking fund which provides for payment of the plant by annual instalments covers also the depreciation, which is a fallacy.

In a recent publication sent to me from the United States by the Municipal Ownership Publishing Co., a list is given of 208 defunct municipal lighting plants, and a map showing their distribution among the various States. It includes the sale, lease or abandonment of the undertakings, and appears to prove that municipal trading in lighting has had many victims.

## TRAGIC END OF TWO ASPIRANTS TO ELECTRICAL KNOWLEDGE.

By ARNOLD LEWIN, A.M.I.E.E.

The writer has recently had to deal with two curious breakdowns on D.C. armatures. In each instance the trouble has been due to a mouse having entered the armature through the ventilating ducts in the core and then having wormed its way right up to the back of the commutator. The breakdown on the winding has occurred in each instance through the mouse's tail having caused a short circuit between the ends of adjacent armature coils, the flesh having rotted away and broken down the insulation. In the first instance, the man who was repairing the armature found a short on same and opened up the wires entering the commutator lugs at that point. When he had lifted up the bottom ends, he saw what appeared to be a broken end of wire projecting between the ends of two coils. He scraped at this with his knife, but could not make out what it was ; on further opening up the winding, some peculiar object was disclosed, and with some difficulty the whole body of a mouse was extricated in a somewhat advanced state of decay. Needless to state, on sending a report to our customer, the explanation was considered an excuse until the body of the victim was offered for examination. The second case occurred on another machine a few weeks later in exactly the same manner. In this instance, the body was so far decayed as to betray its presence immediately the wires entering the commutator lugs were lifted up.

The explanation for the mice entering the armatures is fairly obvious. When the motors had stopped and everywhere was quiet, the mice had come out, and attracted by the heat of the machine, had crept up the holes in the core, burrowed well into the windings and then found it impossible to extricate themselves. Then when the motor was started, they received an electric shock or else they were suffocated.

# THE PRODUCTION OF NITRATES BY THE DIRECT ELECTROLYSIS OF PEAT DEPOSITS.

By GEORGES DARY.

The beneficial effects resulting from the use of nitrates for agricultural purposes are such that their employment is becoming more and more general. Not only do they give reliable results, but all who have employed them speak in high terms of their fertilising properties. The only drawback to their adoption by the large number of small agriculturists is the fact that the price in Europe is still high, for in spite of the great store of natural nitrate deposits, for example, in Chile, which country ships to Europe several million tons a year, and notwithstanding an ever-increasing output of artificial nitrates, the selling price, which ranges between 6½d. and 7½d. per lb. of pure nitrate, is still prohibitive. The question to be solved, therefore, is that of reducing the price as much as possible by improving the methods of extraction from the natural nitrates, and also of perfecting the industrial processes of manufacture.

The Birkeland and Eyde processes employed in Norway enable pure nitrate to be obtained at an average of 6½d. per lb. By the Philippe and Guye method, which produces calcic cyanamide, by separation from calcium carbide, the fixed nitrogen works out at an average of 7d. per lb. The Schonherr system, which gives sodium nitrites, and the Sending process of fixing the nitrogen of the atmosphere in calcium nitride, may also be mentioned. A large quantity of assimilable nitrogen in the form of sulphate of ammonia is also obtained from coal distillates resulting from the manufacture of gas. In this case the fixed nitrogen costs about 10d. per lb.

Sulphate of ammonia, as in the Buckle process, may also be obtained by distillation from dried peat, the cost of the fixed nitrogen being about the same as in the first cases above mentioned. The notable experiments of M. Müntz pointed to a modification of this method of extraction, in the direction of the lixiviation of the peat, followed by a purifying process and a concentration of the mother-waters. The cost and manipulation is, however, too high to permit the method to be adopted industrially.

M. Albert Nodon, well known as the inventor of the electric valve which bears his name, has continued the research work of M. Müntz, and, as a result of long and exhaustive tests, has recently discovered an extremely economical process of extracting nitric acid and nitrates by treating peat deposits electrolytically. The process has recently been patented in the United Kingdom, to which country it is especially suited. By its means, calcium nitrate, which is formed in considerable quantities and continuously in peat deposits can, in fact, be decomposed by electrolysis, the nitric acid passing to the anode, which is enclosed, whilst the lime accumulates about the cathode.

The operation is effected automatically and continuously by means of a simple and cheap plant installed in the open air directly on the peat deposits, this accounting for the fact that the cost of production is practically restricted to that of the current consumed. The Nodon process, in fact, renders the usual heavy expenditure for the extraction, transport and lixiviation of the peat entirely unnecessary, thus overcoming all the drawbacks which led to the rejection of the Müntz scheme.

The industrial arrangement of the Nodon method may be outlined as follows :—Porous pots, filled with coke, which is utilised as the anode, and a weak solution of nitric acid, are installed at equal distances directly in the peat deposits. The nitric acid obtained by the electrolysis of the nitrates of the earth is gathered into tanks, while the lime resulting from the decomposition into calcium nitrate is collected by the cathodes, which latter consist of iron rods sunk into the deposits.

Each element (fig. 1) consists of a cylindrical porous pot *a*, of coarse pottery, rendered porous by the addition, before baking, of a paste of combustible dust. The pots, which are 8 ft. 2 in. in height × 15¾ in. in diameter, are sunk into holes dug in the peat, care being taken to tightly ram the earth below in order that there shall be no movement in the pots.

Each of the latter is filled with washed coke, a large rod of graphite *c* being placed in the centre of the same, its object being to convey to, and distribute, the positive current through the coke. It is very necessary that a perfect joint should be made between the graphite rod and the electric cable, as in batteries; with the view of ensuring this, the upper end of the rod is coppered, lead being cast between this and the end of the copper conductor. Two glass tubes *d* and *e* project into the porous pot. The tube *d* extends practically to the bottom, while the other only penetrates just below the surface of the liquid. The object of the first tube is to draw off the water impregnated with

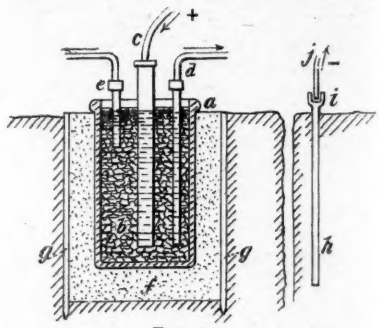


Fig. 1.

nitric acid; while the tube *e* serves to replenish the pot with an amount of water equal to the liquid drawn off. Round each pot a circular space *f* is left, which is filled with calcium carbonate, or simply broken limestone. Stakes of tarred wood *g*, separate the peat from the annular space, which forms a sort of cage for the limestone.

The cathodes or negative poles *h* are of rough cast-iron, and are of a square bar section, 8 ft. 2 in. in length. The upper end *i* is made of a cup shape, into which antimoniated lead is poured, in order to make a good connection with the conductor *j*. The whole is carefully tarred with the view of obviating any destructive action. The rods are located at a distance of approximately 4 in. from each other, and are connected to a common conductor *k* (fig. 2). In this way a cathode of a large surface is secured. The porous pots are

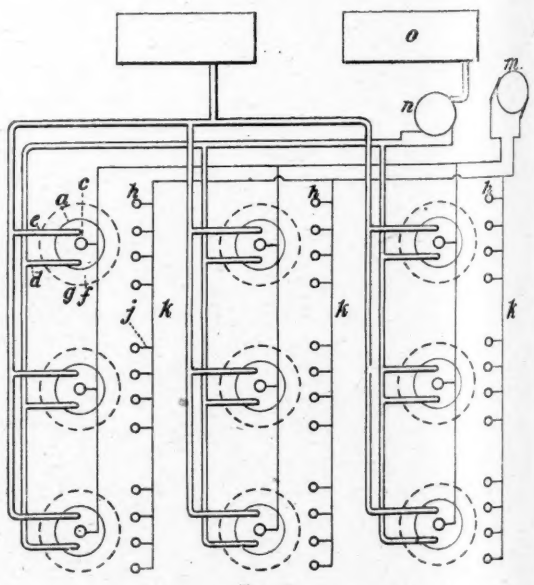


Fig. 2.

fixed at a distance of 3 ft. 3 in. from each other, the shortest space between any of the anodes and cathodes being 1 ft. 7½ in.

As soon as the current is switched on, the following phenomena are observed :—The ground of the peat bog may be regarded as an electrolyte, the specific resistance of which has been found equal to an average of 3 ohms per

metre cube. This resistivity necessitates the employment of a pressure of 10 volts in order to secure sufficient current density. Under the action of this current nitric acid is produced at the anode, and lime at the cathode in accordance with the reaction: $NCaO_3 + H_2O = NH_2O_3 + CaO$.

The nitric acid $NH_2O_3$ remains dissolved in the porous pots *a*; the solution is drawn off along the tubes *d*, and conveyed to a large storage tank by means of pumps *n*, water being admitted by tubes *e* to make up for the liquid extracted. The solution may be directly concentrated in sand-stone evaporators, in order to produce pure nitric acid, for which there is a large demand in connection with the manufacture of tinctorial products. Generally speaking, the free acid is usually saturated with calcium carbonate. The solution is evaporated in boilers fired with dried peat, a calcium nitrate, similar to that supplied for agricultural purposes, being obtained by crystallisation.

Peat is particularly adapted for the intensive production of pure nitrate; in fact, 2 per cent. of its weight consists of nitrogen capable of being converted into fixed nitrogen under the simultaneous action of the nitric ferments, the oxygen of the air contained in the porous mass of peat, the hygrometric water and the heat developed by the passage of the electrical current.

The flow of the current in the peat does not sensibly reduce the activity of the nitric ferments, so long as the density per unit of surface of electrodes is not too high. It is advisable to mix calcium carbonate with the peat, or, simply, a lime milk resulting from the lixiviation of the lime, which accumulates round the cathodes. Without this precaution, the peat becomes impoverished as regards calcium, and the nitric ferments will quickly commence to act on the ground rendered acid by the free nitric acid. It is also well to prevent the development in the nitrate bed of ferments capable of paralysing, as it were, the action of the nitric ferment; this can be done by distributing, by means of a pump, separately-prepared ferment solutions. All these operations can be effected economically by means of electrically-operated pumps and distributing pipes fixed on the peat deposit.

It has been found that the nitric ferment attains its maximum degree of activity at 25° C., while a continuously-flowing current at a pressure of 10 volts is amply sufficient.

A deposit of peat, having a depth of 6½ ft., and an average richness in nitrogen of 2 per cent., can produce between 800 and 900 tons of pure nitrates per year; while, according to the research work of M. Müntz, if the deposit is located near a town, and can be watered with liquid manure, it can be made to yield 6,000 tons of fixed nitrogen.

Presuming that a deposit of peat is worked under the best conditions of efficiency of output, it is found that about 2,500 porous pots, and 36,000 iron rods, weighing together about 13 tons per hectare (1 hectare = 2·47 acres), may be installed.

The industrial efficiency of such an installation, working day and night, works out approximately as follows:—

Current per sq. metre of anodes, 3·33 amperes
Current per porous pot, 7·5 amperes.
Current per hectare, about 18,000 amperes.

One gramme of nitric acid is produced per ampere-hour; thus, in 24 hours 24 grammes per ampere-hour are obtained, one hectare thus producing for 18,000 amperes approximately 432 kg., or 950 lb. The total electrical energy consumed will be 10 × 18,000 = 180 KW.

Current at 100 volts may be utilised, this being more economical than 10 volts; the peat deposit is divided in 10 parallel trenches electrically connected in series in such a way as to give a difference of potential at the two extremities of 100 volts, whilst only using 10 volts in each of the separate trenches.

Peat deposits, from which nitrates are to be obtained, should be located within reach of a supply of hydraulic power. There exist many such unworked deposits in the neighbourhood of abundant streams of water, where electrical energy could be generated at about 24s. per kilowatt. Under these conditions, the price per pound of pure nitrate would work out much less than has been possible by former methods.

In order to more clearly demonstrate the pecuniary profit that may be realised by means of an installation of plant of the Nodon type, some figures furnished by M. Nodon himself, may be quoted:

Estimate of cost of a plant for the electrolytic extraction of 100,000 tons of nitrates per annum from a peat deposit covering an area of 150 hectares (about 370 acres):—

| | |
|---|---|
| Purchase of peat deposit (150 hectares at £20 per hectare) | £3,000 |
| 375,000 electrode elements at 24s. each | 450,000 |
| Cost of water rights and electric power station of 12,000-KW. capacity | 400,000 |
| Evaporating boilers and accessories | 4,000 |
| Electric pumps | 2,000 |
| Rights to use the process | 4,000 |
| Reserve fund | 24,000 |
| | £887,000 |

The interest and depreciation on this outlay, taken together at 8 per cent., would amount to £70,960 per year, or nearly £200 per day, work being taken as carried on day and night for 360 days per annum.

Estimate of daily expenses:—

*Labour.*

| | £ | s. | d. |
|---|---|---|---|
| Six stokers at 4s. | 1 | 4 | 0 |
| Two electricians at 6s. 6d. | 0 | 13 | 0 |
| Four electricians' labourers at 4s. 9d. | 0 | 19 | 0 |
| Two sets of 80 men for working boilers, tanks, transport, &c., at 4s. each | 32 | 0 | 0 |
| Twenty carters at 4s. | 4 | 0 | 0 |
| Ten clerks at 4s. 9d. | 2 | 7 | 6 |
| Two foremen at 8s. | 0 | 16 | 0 |
| An engineer-manager | 1 | 4 | 0 |
| Distributing carbonate of lime, 20 operations per day at 3s. 3d. | 3 | 5 | 0 |
| Six men for digging peat for boiler firing | 1 | 4 | 0 |

*Estimated Cost of Material.*

| | | | |
|---|---|---|---|
| Carbonate of lime, 100 tons per day, at about 4s. 9d. per ton | 24 | 0 | 0 |
| Purified carbonate of lime for saturating nitric acid, 200 tons at 6s. 6d. | 65 | 0 | 0 |
| Maintaining activity of ferments | 8 | 0 | 0 |

*General Expenses.*

| | | | |
|---|---|---|---|
| Upkeep of plant | 12 | 0 | 0 |
| Taxes and insurance | 8 | 0 | 0 |
| Interest on capital outlay and depreciation | 197 | 0 | 0 |
| Printing | 8 | 0 | 0 |
| | £369 | 12 | 6 |

*Approximate Cost of Production.*

| | |
|---|---|
| Daily output of 278 tons of calcium nitrate, costing a total of £369 | £1 6s. 6d. per ton. |
| As 2 cwt. of nitrate contains approximately 38 lb. of fixed nitrogen, the latter costs, roundly | 0·84d. per lb. |

*Annual Profits.*

| | |
|---|---|
| Selling price of 100,000 tons per annum, at £8 8s. per ton | £840,000 |
| Net cost of production, at 26s. 6d. per ton | 132,500 |
| Net profit | £707,500 |

The ingenuity of the Nodon process, and the expert knowledge on which it is based, is such that the greatest praise must be given to its inventor, and that it must attract the attention of both scientists and manufacturers, all of whom, without including agriculturists, are interested in the two questions of the manufacture of nitrates and the utilisation of peat deposits.

**Moving Pictures and Trade Expansion.**—The Moving Picture Exhibition of British Industries, Ltd., has initiated a scheme for assisting British manufacturers in their efforts to develop their trade in foreign countries and the Colonies. The scheme includes as its chief feature the arrangement of a number of tours, which are specified in a pamphlet that has been placed before us, of Europe, North and South America, South Africa and Australia. On these tours moving picture exhibitions will be given in principal cities, illustrating the methods of manufacture, establishments, and the finished articles and their use, of firms who enter into arrangements with the company. The publication and circulation of a commercial reference book is also included in the project. Any of our readers who may be interested in the movement will find particulars very fully set forth in the pamphlet, of which copies can be obtained on application to the company at 86, Leadenhall Street, E.C.

## ELECTRICAL EQUIPMENT AT AUCKLAND HARBOUR.

The Dominion of New Zealand is one of those Colonies where marine communication must be secured at any price. Difficulties of railway transit and its bi-insular configuration render coastal services important, and vessels of large draught also must be accommodated. At Auckland, one of its chief harbours and the Admiralty naval base, an extensive scheme of reconstruction and extension is in progress, and we are indebted to the *Engineering Magazine* for the following particulars, which are of interest.

About nine years ago when the present engineering staff took up its duties, a wooden wharf structure was in existence, but owing to the presence in those waters of a most energetic species of the teredo, a little shell-fish which can literally honeycomb the hardest timbers in a very small number of years, it was seen that the only satisfactory solution was the complete adoption of ferro-concrete for all reconstructions and extensions. After seven years' trial this has proved an entire success. The scheme decided on has been partly carried out, and is being completed at a rate which keeps the accommodation of the port well in advance of its requirements.

In the matter of the adoption of machinery, as no special plant existed previously, the choice between hydraulic power and electricity was unfettered in any way. The latter was chosen partly because the heterogeneous nature of the cargo to be dealt with, rendered desirable a source of power which should be uniformly economical at various loads.

The original wharf plan comprised side jetties branching from central piers, which, although satisfactory when first constructed, was open to serious objections as a permanent scheme, and it was decided to adopt a purely longitudinal arrangement of piers. Originally also a single line of sheds ran down the centre spaces and ships discharged into these from either side, whilst carts were admitted to them for loading and unloading purposes. Further, all cargo moving inside the sheds was done by hand.

The drawbacks to this manner of dealing with goods were many. Numerous vehicles caused congestion of the quay space and were a hindrance to speedy handling, and cargoes of different ships and of ships belonging to different companies became mixed. A solution of the difficulty was found in the construction on each pier of a double row of sheds with a roadway between. Inside these sheds the floors slope gently upwards from the quays on the outer sides, to cart level on the inner sides, and as the slope is an easy one for truckers, all vehicles are excluded. Vessels are berthed on both sides of the piers and each quay has two lines of railway, let in flush, so that carts may use the same roadway for direct removal of goods when required. The wharf sheds are single or double storey according to the pier capacity, except in one case where the original single-storey, single-shed principle, was considered sufficient to meet the requirements of a fleet of smaller coasting vessels. The complete scheme includes the reclamation of about 100 acres by means of sea walls and quays, and some 32 acres have already been roaded and let at high prices.

The machinery equipment of the port is closely associated with the design of the wharves. The decision was made that no crane of a greater lifting capacity than 5 tons should be installed, thus enabling wharf construction costs to be kept down to a very low limit. For excessive lifts a floating crane of 80 tons capacity is employed. The present equipment consists of 13 5-ton cranes, one 3-ton, and four 15-cwt. shed cranes. Most are "semi-portal" supported, thus leaving the quay space obstructed to the least possible extent, but four have their back legs on the quays.

In the "semi-portal" type one leg only runs on the wharf coping, the other being carried on a crane rail on the eaves of the single-storey sheds. In the case of the two-storey buildings, the rails run on the edges of special balconies. Their superiority has been so fully appreciated that all future additions will be of this type. Nine of the larger cranes are of the two-motor variety, by Messrs. Babcock & Wilcox—one motor of 60 B.H.P. controlling hoisting and derricking, and one of 5 B.H.P. for slewing. The former is geared to its two functions by means of the makers' "Crypto" sun-and-planet mechanism, and is accordingly compound wound, while the latter, being always in mesh, is series wound. Lowering is carried out by a powerful foot brake on the free-barrel system, and the hoisting speeds are 230 and 120 ft. per minute. On the four latest cranes by Messrs. Carrick & Son, all operations can be performed simultaneously, as three motors are provided—the extra one for derricking being of 15 B.H.P. The current supply is through plug boxes on the shed walls at 60-ft. intervals, by means of flexible cables.

The 15-cwt. shed cranes are by Messrs. Stothert & Pitt, and are each fitted with one 5-B.H.P. shunt motor, which, by means of friction clutches, performs the double duty of hoisting and slewing. They are moved from place to place by hand.

On the quays, capstans at convenient distances give a 1-ton pull at 200 ft. per minute, the motors being of 20-B.H.P. capacity, with pedal-operated entirely automatic starters, by the General Electric Co., of England.

In the two-storey sheds conveyors and lifts are necessary. For the former 15-H.P. motors, by Messrs. Scott & Mountain, are in use, and give a conveyor speed of 10 ft. per minute with a 1-ton load. For the lifts, which are by Messrs. Smith & Stevens, 10-B.H.P. motors are installed, and the carrying capacity is 1 ton 120 ft. per minute. On the top floors, Wadsworth hoists, fitted with 13-B.H.P. motors, are provided. These lift 1 ton at 120 ft. per minute, and can hoist from carts in the road, travel in to the centre of the shed, or handle goods through a well in the floor.

In the Dry Dock, two Rhodes 25-B.H.P. shunt interpole motors connected to Gwynne pumps in a single reduction, 750 to 100 R.P.M., raw hide to steel, spur gearing, have replaced a steam plant, and effected a great saving by reducing the working hours of the staff. A 30-B.H.P. compound-wound B.T.H. motor operates the 200-ton slipway.

The entire lighting system is electric. Originally 2,000-C.P. flame arcs, on revolving towers at the corners and eaves of sheds, for additional light, whilst vessels were working, were in use, but owing to the rapid action of the salt atmosphere on the regulating resistances these were superseded by tantalum lamp clusters. Inside lighting is effected by 800-C.P. Trafford enclosed arcs and 100 C.P. tungsten lamps, and as walls and ceilings are painted white throughout, the diffusion is excellent. The Queen Street Wharf, being a continuation of the main street of the city, will be specially lit by a central row of four 1,000-C.P. tungsten lamps, with seven 100-C.P. lamps to serve between 10 p.m. and dawn.

The operations of the time ball and various other functions, such as tug and dredger lighting, workshop lighting and driving, &c., are carried out electrically, and altogether some 1,500 B.H.P. is employed in the Harbour Board's Service. The new generating station of the municipality is erected on the approach to one of the wharves, and affords a convenient and cheap source of power.

It will be seen, therefore, that excellent progress is being made, and as the cost of the new wharving is no greater than that of the old, very great credit is due to the staff. With such management, the port must be one of the greatest factors in the success of the City and Province of Auckland.

## BRITISH TRADE WITH RUSSIA.

Manufacturers who want to sell their goods in Russia must adopt no half-hearted measures. The Russian market is a very large one, and its possibilities in the future are incalculable. For the time will come when, through the development of industries, its purchasing power will no longer depend upon the harvest. Therefore if it is worth while entering the market at all it is worth doing so on a large scale. This means that money will have to be spent in gaining experience and in advertising, for which no immediate adequate return can be expected. Bearing on this subject the British Consul at Odessa in a recent report states that in view of the revision of the commercial treaty between Russia and Germany, the Minister for Trade and Industry recently enquired of the Chambers of Commerce for their opinion as to how the recent remarkable progress made by Germany in the Russian market was brought about. The Consul gives an extract from a reply to this inquiry which is copied below. He adds that it is probably exaggerated, for no doubt the perfect German traveller is still to seek, nevertheless it is of interest as exhibiting a high standard to which travellers should aspire. The extract referred to is as follows:—

"During the last ten years there has been noticeable increase in the number of German commercial travellers in the hardware and metal industries, that is for the sale of various machine tools, steel, belting, general tools, electrical appliances, stamped goods, lubricating products, emery goods, patented productions, paint, &c.

"The German traveller is distinguished by his thorough acquaintance with the goods he offers; he knows exactly how the article is produced, to what points he must direct attention, and what is likely to interest his customer; he is always well informed as to current prices and the quantity of goods in the market; in making offers he is guided by local conditions. The majority of German representatives have a fair knowledge of Russian and are of an intelligent class; compared with Russian travellers they stand higher. The latter has seldom any preparation for his task, and is often not competent to show the good points of his wares and to call attention to their peculiarities and advantages as compared with goods offered by his competitors. The majority merely hand in price lists showing the conditions of sale, not interesting themselves in the suitability of their goods to the place, or as to whether there is any novelty of recent improvement in the same line. Russian representatives are to be found travelling one day in paint, the next in hardware.

"German firms, in order to extend the sale of their goods, often send out gratis samples (particularly light ones) asking people to try them and report on them; they follow up by sending a traveller. They are exact and punctual in fulfilling orders, and careful as regards packing their goods. They often allow long credits, and with firms of good repute facilitate matters by not demanding acceptances. Many habitually deliver their goods duty free at buyer's doors, themselves paying all expenses. In order to bring their wares before the public they send copious advertisements, catalogues, placards, pamphlets, almanacs and gratuitious small samples, and show persistence in offering their goods. Any novelty is immediately brought to the notice of buyers and samples are sent, to be returned if

not satisfactory. German firms willingly open credits; they are evidently themselves not pressed for cash, often taking no interest in ready-money sales, and giving a minimum discount for cash as compared with Russian dealers; occasionally they have offered as low as 2 per cent., per annum, as discount for cash. Several German firms are opening branches in Russia in order to become better acquainted with the market.

"It is proper to add that English and French firms, notwithstanding the excellence of their merchandise, do not yet push their goods by the methods employed by the German."

Dealing with the question of credit the Consul states that before undertaking commercial enterprises in Russia British firms would do well to study the requirements of Russian law and the experience of business firms already established in Russia with regard to its working. The bankruptcy laws facilitate fraudulent bankruptcies, and the honest trader has a very hard struggle to make a living. The dishonest trader's modus operandi is as follows:—He works on a 5 per cent. profit for a few years, thereby getting the bulk of his special line of trade into his hands, and then goes bankrupt, eventually paying about 4s. in the £; sometimes a firm can escape liability for its debts by changing its name. The newly-named firm—which may be the same as the original firm in everything except name—cannot be sued for the liabilities of the former; there is no remedy unless it can be proved that the change has been made for fraudulent purposes, proof of which is probably very difficult to obtain, and even if obtainable the suitor must overcome endless legal stratagems and devices, with the probability that when the verdict is at least obtained the defendant may declare himself bankrupt and leave the plaintiff to pay his own costs. New legislation approved by the Council of Ministers is being introduced to remedy this state of affairs. On this subject the Vice-Consul at Kharkoff writes:—

"Much money has been lost by foreign merchants not intimately acquainted with the country, especially in dealing through agents of indifferent standing. Russian manufacturers suffer equally with the foreigner.

"For a number of years public bodies representing commercial interests have been pressing for legislation, and the draft of a new law that will prevent the more daring frauds and hasten proceedings in bankruptcy, has been presented to the Duma. The new law, coupled with the gradual improvement of trade references and a more perfect intelligence service, will considerably ease the British merchant's task. At present the number of trustworthy agents is very limited, commercial references require careful sifting, and exporters to Russia must be very watchful to preserve themselves from loss. Trade references must on no account be blindly trusted, as intelligence bureaux are not interested in curtailing a client's foreign credit.

"The Association of Moscow Manufacturers circulates among its members and banking institutions the names of defaulting firms, and these lists are appalling to a stranger. Similar proceedings are taken by the Odessa and Warsaw associations and by the Association of Russian Agricultural Engineers, which are in this matter affiliated. A general boycott, or concerted proceeding, follows such a publication and forces payment where funds still exist, or at least preserves other members from harm."

The Vice-Consul at Mariupol also deals with the question and points out that owing to the keen competition it is easy to obtain discounting credit, and thus firms with little or no capital are enabled to carry on a large business, quite out of proportion to their means, with the natural result that, immediately they incur even a small loss, they are unable to meet their liabilities. In most cases, in order to keep in favour with the banks, with a view to future business, the latter are paid in full, but private firms fare very badly and generally lose everything.

Another point which a capitalist should know before investing money in Russian enterprises is the system under which income tax is assessed. The tax is payable on the turnover, so that income tax may have to be paid when there has been a dead loss on the year's trading. To take another point which often requires immediate attention; when the head of a Russian firm dies and it is desired to continue business relations with his successor, it should be understood by the British firm that the Russian firm's financial position may have been considerably modified through the effect of the Russian law of succession. By this the firm's property may have been divided into numerous small parts and alienated from the common stock, so that the firm may be in a weaker financial position than before. Again, great care must be taken to use the correct revenue stamps for invoices, contracts, &c., as fines are heavy for contraventions of the law which, too, is very difficult to understand.

These warnings do not exhaust the pitfalls which may beset the unwary capitalist. They indicate dangers which may be either discounted in advance or avoided altogether, and are given, not with the object of preventing the investment of British capital in Russia, but to emphasise the necessity of making careful inquiries before entering upon commercial enterprises. In South Russia close inquiry is particularly necessary because all business is on a credit basis, so that a client's antecedents must be carefully investigated. This can be done through commercial information bureaux, but the safer plan is for representatives to be sent out to make inquiries on the spot and to establish personal relations with the heads of firms.

On the general question of British trade with Russia the Vice-Consul at Kharkoff points out that British goods imported into Russia show a gradual falling-off both actually and proportionally. British trade with Russia is really even less prosperous than the actual figures lead one to suppose because it is in manufactured goods that we are particularly losing ground. This is especially to be regretted in the case of machinery, because British manufacturers should and could compete in excellence of quality and in price if properly supported by a trade organisation. The Vice-Consul quotes the following as the causes to which he attributes our failure:—

1. Want of knowledge of the country, which makes it difficult to give the usual trade credits.
2. Want of British trading houses and of industries under British management in Russia, and the natural preference of merchants and manufacturers to purchase from the country to which they belong by birth and sympathy.
3. The less favourable transport facilities from the United Kingdom causing more expensive packing, higher charges for postal packages, and longer journey.
4. The high tide of the British industries in recent years causing manufacturers to be indifferent to the Russian trade, and also, in the case of machinery, preventing prompt execution of orders.
5. The erroneous information being spread, and very generally believed, that British industries are behind the times and are left in the background by Germany's progress.

## THE ELECTRICAL STERILISATION OF MILK.

At a meeting of the Rontgen Society on December 2nd, a paper was read by Prof. W. G. Duffield on the sterilisation of milk by means of electrified gases. Prof. Duffield referred to the work recently done on the subject by Thornton and others, and notably by Priestly and Lee, who brought before the British Association in 1911 some experiments in which they had applied weak currents of electricity upon the "sour milk" bacillus of Metchnikoff. In one respect the conclusions of Priestly and Lee differed from those which he had to bring forward, for under certain conditions they got an increase of acidity after electrisation, whereas he had found that the acidity was greatly reduced or retarded. The apparatus used in his own experiments, in which he was assisted by Mr. T. Murray, was a 15-inch induction coil, with a fairly "fat" spark 4 centimetres in length. The poles were of brass. The spark discharge was passed through a closed glass tube, and air or nitrogen, which in certain of the experiments was filtered through cotton wool, was sucked in, and made to convey the products of the discharge into samples of milk. The acidity of the milk was then tested at intervals of hours, and compared with the acidity of a control sample, which had not been treated. The testing of the acidity was carried out by discovering the amount of alkali necessary to produce neutralisation in a given number of cubic centimetres of milk. It was at once found that the acidity of the treated sample was greatly retarded as compared with the untreated. The acidity in the former case appeared quickly to reach its maximum, and then to remain stationary, whereas in the latter case it ran up rapidly. In one instance in which the electrical discharge had run for 52 minutes, the relative acidities at the end of 64 hours (as expressed in c.c. of alkali necessary to produce neutralisation in 10 c.c. of milk) were 9 in the case of the control and 5.9 in the case of the treated sample. The effect seemed to be more pronounced the longer the electrical discharge had been allowed to run, notably in one case for 71 minutes, whereas very short exposures of one minute or five minutes gave little or no difference between the two samples. The cause of the reduction in acidity was still doubtful. Some tentative experiments seemed to show that it was chemical rather than electrical in nature. A bacteriological examination proved that when the samples were sown on plates of agar and of gelatine, the inhibitory action in the case of the electrified milk had been as pronounced as the acidity tests had suggested. There was a marked diminution in the germ colonies in the samples, and it even appeared that the germicidal or toxic effect remained for at least five days after the original discharge.

Asked by Mr. C. E. S. Phillips as to any scientific basis for the popular idea that thunderstorms soured the milk, Prof. Duffield said that his own work pointed in the opposite direction, but, of course, temperature effects had to be considered.

Dr. Horace Manders thought that some clue could be obtained as to the existence of the purely electrical influence if different metals were used at the positive pole, and the degree of destruction of the spore-bearing organisms was noted.

Mr. W. Duddell thought that since Prof. Duffield had used a spark discharge, it would be interesting to know whether similar effects could be obtained with a brush discharge, and if so this would seem to indicate that the action was due to chemical bodies formed by the discharge. He thought it possible that the decisive agent was ozone.

Mr. F. H. GLEW said that the results might be explained to some extent if it were assumed that during the spark discharge portions of the metal were thrown off in a colloidal condition, and that these passed into the milk. The action of colloidal particles in various substances had been recognised now for some time, especially as a cause of certain fermentative changes.

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this Journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

27,575. "Electric bell contacts and the like." A. H. MARSH. December 1st.

27,577. "Lamp lock for incandescent electric lamps." W. J. CUNLIFFE. December 1st.

27,578. "Electric indicating apparatus." R. ORME. December 1st.

27,582. "Electric arc lamps." A. H. RAILING and A. E. ANGOLD. December 1st.

27,590. "Cramp-belts adaptable as electrode contact cramps and holders, and for other purposes." J. S. ROMANES. December 1st.

27,595. "Electric indicator that will denote to a driver or person in charge of a train when a distant signal is against him." C. H. I. PHILLIPS and H. W. BRADING. December 1st.

27,596. "Trolley wheel or sheave." A. E. LINEBERG. December 1st.

27,599. "Method and apparatus for the regulation of gas pressure in Röntgen tubes, vacuum tubes, and the like." F. A. LINDEMANN. December 1st. (Convention date, December 2nd, 1912, Germany.) (Complete.)

27,611. "Application of electrical energy to motor-cars, motor-boats, and the like." F. A. WILKINSON. December 1st.

27,613. "Röntgen tube for excitation by high tension alternating or continuous currents." S. H. WRIGHT. December 1st.

27,615. "Automatic regulation of electric circuits." C. A. VANDERVELL and A. H. MIDGLEY. December 1st.

27,621. "Treatment of gases by electricity, and apparatus therefor, chiefly for the production of nitrogen compounds." A. G. R. FOULERTON. December 1st.

27,633. "Absorption pyrometers." G. A. ALDER and A. O. COCHRANE. December 1st.

27,641. "Electric fuses." H. W. YOUNG. December 1st. (Convention date, December 14th, 1912, United States.) (Complete.)

27,646. "Circuit arrangements for telephone systems." SIEMENS & HALSKE AKT. GES. December 1st. (Convention date, November 30th, 1912, Germany.) (Complete.)

27,647. "Treatment of solid, liquid, or gaseous substances for purifying them or rendering them electro-active." R. MARCUS. December 1st. (Complete.)

27,657. "Electric incandescent lamps." PROGRESS MOTOREN-UND APPARATENBAU G.M.B.H. December 1st. (Convention date, October 14th, 1913, Germany.) (Complete.)

27,660. "Protection of electrical distributing or current-carrying systems." H. W. CLOTHIER. December 1st.

27,661. "Protection of electrical distributing or current-carrying systems." P. V. HUNTER. December 1st.

27,679. "Telephone instruments." E. A. GRAHAM. December 1st. (Complete.)

27,684. "Automatic telephone system." W. D. EDWARDS. December 2nd.

27,707. "Telephone instruments." W. AITKEN. December 2nd.

27,734. "Sleeve insulators for high tension." AKT. GES. BROWN, BOVERI, & CIE. December 2nd. (Convention date, December 9th, 1912, Germany.) (Complete.)

27,746. "Commutators for dynamo-electric machines." H. MENSFORTH. December 2nd.

27,750. "Electric switches." D. K. MORRIS and MORRIS & LISTER, LTD. December 2nd.

27,753. "Telephone systems." E. A. GRAHAM. December 2nd. (Complete.)

27,754. "Telephone exchange-boards." E. A. GRAHAM. December 2nd. (Complete.)

27,764. "Shades for electric and other lights or lamps." J. TAYLOR (trading as TAYLOR & Co.) December 2nd.

27,771. "Electric glow lamps." E. A. KRUGER and K. SANNIG. December 2nd. (Complete.)

27,793. "Gas and electric lamps or fittings." EVERED & Co., LTD. and J. E. BOXALL. December 3rd.

27,824. "Relay arrangements for the automatic control of electric circuits or apparatus." SIEMENS-SCHUCKERTWERKE G.M.B.H. December 3rd. (Convention date, December 4th, 1912, Germany.) (Complete.)

27,852. "Method of maintaining a dynamo at a constant electromotive force." J. F. J. BETHENOD. December 3rd. (Convention date, December 27th, 1912, Belgium.) (Complete.)

27,859. "Electro-magnetically controlled perforating apparatus." B. SOLDATENCOW. December 3rd. (Addition to 14,658/10. Divided Application on 5,352/13. March 3rd.) (Complete.)

27,862. "Secondary battery plates." S. S. GALSWORTHY, C. A. OWEN, and R. J. FLETCHER. December 3rd.

27,870. "Electric switches." A. BONNELLA and G. J. BONNELLA. December 3rd.

27,875. "Electricity meters." KORTING & MATHIESEN AKT. GES. December 4th. (Convention date, May 16th, 1913, Germany.) (Complete.)

27,876. "Arc lamps." KORTING & MATHIESEN AKT. GES. December 4th. (Convention date, May 24th, 1913, Germany.) (Complete.)

27,877. "Electricity meters." KORTING & MATHIESEN AKT. GES. December 4th. (Convention date, December 21st, 1912, Germany.) (Complete.)

27,878. "Arc lamps." KORTING & MATHIESEN AKT. GES. December 4th. (Convention date, December 21st, 1912, Germany.) (Complete.)

27,900. "Methods of electrically welding steel." W. ANDREWS. December 4th.

27,905. "Telephone switching-mechanism." M. S. CONNER. December 4th.

27,927. "Sparking-plugs." L. HOPCRAFT. December 4th.

27,945. "Method of maintaining a dynamo at a constant electromotive force." J. F. J. BETHENOD. December 4th. (Addition to 27,852/13. Convention date, January 18th, 1913, Belgium.) (Complete.)

27,948. "Joints for metallic conduits and fittings for electric cables." SIMPLEX CONDUITS, LTD. and L. M. WATERHOUSE. December 4th. (Complete.)

27,973. "Means for controlling electric motors." J. E. OLVIS. December 4th.

27,988. "Arrangements for starting and regulating direct-current electric motors." F. CUMONT. December 5th. (Addition to 8,108/12. Divided Application on 7,983/13. April 4th.) (Complete.)

28,006. "Electric signalling-system for railways." C. C. WILSON. December 5th.

28,018. "Rubber substitutes for insulating and other purposes." J. F. BENNETT and A. T. MASTERMAN. December 5th.

28,019. "Electric starters and lighting and battery systems applicable to motor-vehicles and the like." W. H. GLASER and H. R. LLOYD. December 5th.

28,021. "Means for cleaning the ends of electrical conduit tubes." M. RAILING and T. TAYLOR. December 5th.

28,024. "Electric lighting distribution systems." COLD LIGHT (DUSSAUD PROCESSES), LTD., and G. E. HALES. December 5th.

28,025. "Electric lighting apparatus." COLD LIGHT (DUSSAUD PROCESSES), LTD., and G. E. HALES. December 5th.

28,028. "Automatic mechanical cut-in and cut-out for dynamos." G. PEARSON and LOTHAR FIELDER. December 5th.

28,059. "Electric and vibratory horns or alarms and methods of operating same." E. V. GRATZE. December 5th.

28,077. "Electric metering systems." BRITISH THOMSON-HOUSTON CO., LTD. and E. GARTON. December 5th.

28,111. "Tripping-devices for electric switches and the like." J. G. STATTER. December 6th.

28,125. "Apparatus for the communication of indications electrically, on the step-by-step system, from a transmitting-station to a receiving-station." A. BARR, W. STROUD, and J. W. FRENCH. December 6th.

28,135. "Process of and apparatus for decolouring or bleaching textile materials electrolytically." D. A. TURNBULL and L. G. LAWRIE. December 6th.

28,141. "Telephonic transmitters." M. S. CONNER. December 6th.

28,152. "Apparatus for electro-plating iron and steel plates with other metals." S. O. COWPER-COLES. December 6th.

28,159. "Ringing cut-off relay systems." WESTERN ELECTRIC CO., LTD. December 6th. (Franklin Tuthill Woodward, Belgium.)

28,162. "Electrical cooking or heating apparatus." R. S. DOWNE and W. TRAVIS. December 6th.

28,178. "Electric penholder or penhandle." J. B. FURLONG. December 6th.

28,179. "Electric rear and head light." J. STALLY and H. TIBBS. December 6th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1913.

ELECTRIC WIRE FUSES. E. Weissberg. 11,298. May 14th.

PORTABLE ELECTRIC LAMPS. G. F. Hitzelberger and New British Ever-ready Co. 13,175. June 6th.

SWITCHING APPARATUS FOR THE INSIDE LAMPS OF MOTOR VEHICLES. E. Freitag. 14,306. June 20th.

PORTABLE LIGHT-PROJECTING APPARATUS. J. Y. Johnson. (F.I.A.T. Fabrica Italiana Automobili Torino and Soc. Anon. Officine Galileo.) 14,711. June 25th.

WALL PLUGS OR FIXING SOCKETS. I. B. Malaby. 15,180. July 1st.

COUNTING TRAINS FOR ELECTRICITY METERS. A. Mascall, and Chamberlain and Hookham, Ltd. 16,344. July 16th.

SOCKETS FOR ELECTRIC LEADS. A. G. Bloxam. (R. Bosch (Firm of)). 16,709. July 21st. (Addition to 6,551/13.)

ELECTRIC FUSE. W. B. Boyd and J. B. Tannahill. 19,551. August 29th. (Addition to 12,273/13.)

**Ozone and Public Health.**—Referring to recent attacks on ozone by American medical authorities, Dr. C. P. Steinmetz wrote to the *Electrical World* of November 29th to say that some of the conclusions reported by the experimenters appeared to him inconsistent, so that it might be well to caution the reader against accepting them without further evidence. For instance: "Guinea-pigs were harmed and killed by a very high concentration of ozone, and from this the conclusion is drawn that an extremely low concentration of ozone is harmful. With the same reasoning, since guinea-pigs kept in pure oxygen are harmed and killed, the conclusion may be drawn that the 20 per cent. of oxygen contained in the air which we breathe is harmful and that we are all in imminent danger of death. Any corrosive non-poisonous agent in sufficient dilution becomes harmless, and while, for instance, the drinking of concentrated hydrochloric acid would be fatal, free diluted hydrochloric acid normally exists in our stomachs as an agent of digestion.

"Also, the report states, ozone in higher concentration destroys odours, while in low concentration it 'masks' them. It is hard to conceive, without very conclusive evidence, why the action of ozone should be different in one case from its effect in the other.

"The experiments with bacteria described are hardly remarkable. I believe any chemist would have predicted that under the conditions of the experiment ozone should have no effect on bacteria. . . . . The last number of *Chemical Abstracts* (November 10th) gives a list of nine European cities in which water sterilization by ozone is in successful operation, and abroad such public works are not constructed without previous comprehensive study of the process by competent scientific authorities. . . . It would, in the interest of the electrical industry, be extremely desirable if a comprehensive and impartial investigation on ozone and its industrial, domestic and medical use were made by a competent group of scientists. Such investigations, however, could not be carried out by men of one profession only without leading almost certainly to wrong conclusions caused by generalisations from special cases, as I pointed out above. A proper study of the problem, indeed, would require the co-operation of competent physicians, physicists and chemists."